

INVESTIGATION OF THE EFFECT OF
STIFFNESS OF MEMBERS UPON
THE SOLUTION OF VIERENDEEL TRUSSES

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Thesis
M3

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UPON THE SOLUTION OF VIERENDEEL TRUSSES

by

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Submitted to the Faculty of Rensselaer Polytechnic Institute in Partial Fulfillment of the Requirements for the Degree of Master of Civil Engineering.

Troy, New York

June 1, 1948

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ACKNOWLEDGEMENT

The authors wish to gratefully acknowledge the assistance of Mr. A. Amirikian, Principal Engineer of the Bureau of Yards and Docks, Navy Department, and Professor J. S. Kinney of the Civil Engineering Department, R.P.I., for their many helpful suggestions on the preparation of this thesis.

Introduction

A Vierendeel Truss is composed of a series of rectangular or trapezoidal panels without diagonal members. It is named for its inventor, Professor Arthur Vierendeel of the University of Louvain in Belgium. This type of truss has been popular in Europe, particularly in Belgium, since 1896 when the first bridge of this type was built in that country. In the United States its use to date has been limited to concrete viaduct bents, small roof trusses, and rigid frame foundations for buildings. It has been reported that a bridge using a concrete Vierendeel Truss system has been built recently on the West Coast, but as yet there is no printed matter available on that project.

The Vierendeel presents an exceptionally good appearance, the elimination of diagonals allowing a very clean looking structure. Its slow adaption in this country may be attributed to two factors; (1) until recently the only methods of solution were extremely long and tedious, sufficiently so to discourage only the most able and experienced in the field of structural design, and (2) the use of this truss has been so limited in this country that very few examples are available from which to make an intelligent investigation of the economic aspects of the problem.

METHOD OF SOLUTION

The method of solution used throughout this thesis was an application of slope deflection as outlined by Mr. A. Amirikian in his "Analysis of Rigid Frames". While there are other methods available for the solution of Vierendeel trusses it was felt that the procedure outlined by Mr. Amirikian was the simplest and most direct approach to the problem published to date. Inasmuch as his text has become a standard addition to all libraries of treatises on Indeterminate Structures, none of the derivations will be presented here and only a brief outline of the basic formulae and procedures will be given.

By way of simplifying the fundamental moment equation of a member having constant moment of inertia and modulus of elasticity

$$M_{AB} = 2 E \frac{I}{L} (2\theta_A + \theta_B - 3 \frac{\Delta}{L}) - FM_{AB}$$

the following abbreviated form is used

$$M_{AB} = K (A + \frac{B}{2} - R) - FM_{AB}$$

where

$$K = \frac{I}{L}$$

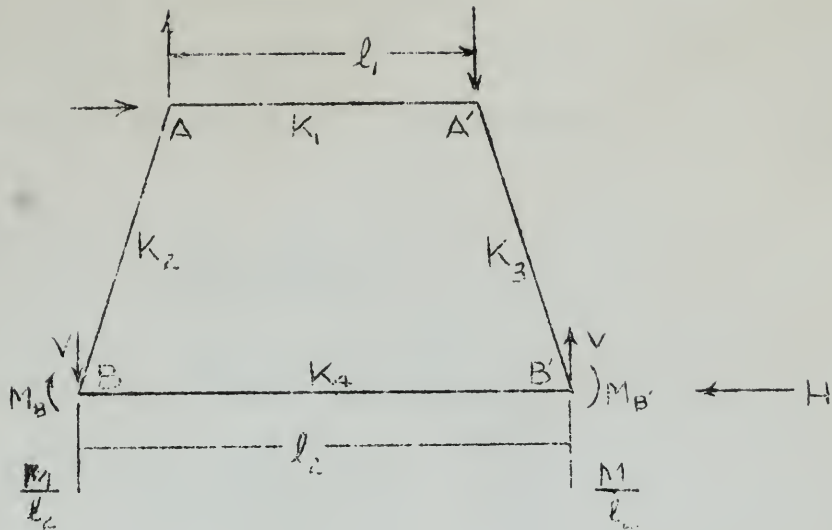
$$B = 4E\theta_B$$

$$A = 4 E\theta_A$$

$$R = 6E \frac{\Delta}{L}$$

This simplification is used throughout the solution and greatly reduces the tediousness of the more complex equations.

Upon connecting four of these beams to form a panel and a series of panels to form a truss, the interdependence of the members and joints becomes pronounced. In order to consider the effect of varying stiffnesses in members forming or adjacent to a joint on both the moment at the joint and the deflection in the beam, expressions are developed for each joint encountered. These expressions will be known hereafter as the Joint and Deflection Equations. Likewise the moments obtained in the solution of any joint will vary widely with the shape of the panel, moments and shears applied and location of application, and the stiffnesses of the panel under consideration. In order to take these variables into consideration, Load Constant Equations are derived for each joint. Upon solution of these equations the load constant is equated to the Joint and Deflection equations which are then solved to find the deflection angles of the joints and the deflection of the adjacent member. Because of its basic nature the fundamental expression for the load constants of a typical panel are reproduced here in part.



$$(a) \quad M_B + M_{B'} = V l_2 - H$$

$$(b) \quad M_A + M_{A'} + M_B + M_{B'} = V(l_2 - l_1) - Hh$$

Substituting V from (a) in (b)

$$(c) \quad M_A + M_{A'} + (1-m)(M_B + M_{B'}) = mH - Hh$$

where

M = overturning moment of the external forces taken about the bottom of the panel.

H = shear, i.e., the sum of the lateral forces above the panel.

V = vertical reaction just above the bottom joints of the panel.

M_A = end moments at top.

M_B = end moments at bottom.

Q = values of load constant for joint or panel under consideration.

$$m = \frac{l_2 - l_1}{l_2}$$

$$n = \frac{l_1 - l_2}{l_1}$$

By substituting the right hand part of equation (c) in a previously developed shear expression for a typical joint equation we arrive at load constants for a typical panel

$$Q \text{ of R} = \frac{Hh - mM}{(2-m)(k_2 - k_3)}$$

$$Q \text{ of A} = \frac{(nk_1 - k_2)(Hh - mM)}{(2-m)(k_2 - k_3)}$$

$$Q \text{ of B} = \frac{k_2 (mM - Ph)}{(2-m)(k_2 - k_3)}$$

Further importance is attached to equation (c) inasmuch as it acts as a check for the moment values obtained in the solution of any panel.

The procedure for the solution of Vierendeel trusses is an adaptation of this single panel solution. In order to avoid the difficulty of an exact solution the truss is first treated as a system of separate and independent panels. Each panel is solved for its own load neglecting moment introduced from other panels via the joints. To compensate for the error introduced in the original computation the solution is repeated, this time using the moments obtained from adjacent panels as the new load constants for the panel being solved. The procedure is repeated, again interchanging moment increments between panels. Inasmuch as these increments diminish in size rapidly, two corrections will ordinarily provide a solution of sufficient accuracy.

The final moment will be the algebraic sum of the original moment determination and the successive increments.

For the Vierendeel truss used in this design with all loads applied at the panel points and the upper and lower chords having the same stiffness ratio, the deflection angles of the top chord joints will equal those of the respective bottom chord joints, and the joint and deflection equations become:

$$1.5K_1 + K_2 + \frac{(3 - m)(nk_1 - k_2)}{2(2 - m)} A =$$

$$\frac{k_2}{2} + \frac{(3 - 2m)(nk_1 - k_2)}{2(2 - m)} B = -Q_A$$

$$k_2 + 1.5K_4 + \frac{(3 - 2m)k_2}{2(2 - m)} B =$$

$$\frac{k_2}{2} + \frac{(3 - m)k_2}{2(2 - m)} A = -Q_B$$

$$R_1 = \frac{(3 - m)A + (3 - 2m)B}{2(2 - m)} = Q_{R1}$$

These equations, with appropriate K and angle notation are set up for each of the eight panels and equated to the corresponding load constants as obtained from the following formulae:

$$-Q_A = \frac{(nk_1 - k_2)(m\bar{r}_1 - H_1l_1)}{2(2 - m)k_2}$$

$$-Q_B = \frac{(H_1l_1 - m\bar{r}_1)}{2(2 - m)}$$

$$Q_{R1} = \frac{H_1l_1 - m\bar{r}_1}{2(2 - m)k_2}$$

The two equations in A and B obtained from the solutions of these sets of equations are then solved simultaneously and the value for R_1 determined. Substituting in the fundamental moment formulae

$$M_{LB} = K \left(A + \frac{B}{2} - R_1 \right)$$

$$M_{BA} = K \left(B + \frac{A}{2} - R_1 \right)$$

the original moment values for the panel are obtained. These moments are then corrected and the sum of the original moment plus corrections give us the final moment values.

Influence lines were plotted for the final moment values and design moments based on the combined loadings of one E-60 railroad rail and one lane of H15 - S12 - 44 highway loading were computed.

PURPOSE

The purpose of this investigation is to determine the influence of the assumed stiffnesses of the members upon the eventual design of the truss.

In the design of a Vierendeel truss by the method previously described, the first step is to assume a basic truss and loading system. A solution is then worked for this primary system, corrected for the actual loads and conditions, and the solution repeated with appropriate corrections to arrive at the final design, usually three or more solutions being required.

Upon embarking upon this type of solution, the engineer is faced with two fundamental assumptions, (a) the loading to be used, and (b) the stiffnesses to select for his members. The first of these may be handled in the conventional manner, i.e. assume a loading of one kip and compute values for plotting influence lines to which he may later apply his design loads.

The second assumption, selecting appropriate stiffnesses for his members, presents a more difficult problem. Unfortunately so little material has been published on Vierendeel trusses in this country that there is little to guide him in this step.

Likewise the rarity of this type of structure in the United States makes it extremely unlikely that he could obtain any useful data on existing cranes of this type. Obviously it is up to the engineer to make such assumptions as he sees fit. In order to do this properly he should, of course, have some advanced knowledge of the distribution of moments throughout the truss in order that he could correctly proportion his stiffnesses to their appropriate moments. Previous experience lacking, he will be forced to estimate the probable moment intensities and select stiffnesses accordingly. This procedure leaves much to be desired, for regardless of a man's previous experience it is not to be expected that he could closely approximate the distribution of moments in a truss entirely unfamiliar to him, and his stiffness values will be subject to the same degree of uncertainty.

The question now arises as to the degree in which the assumed values of stiffnesses will affect the solution of the truss. It will be noted that the stiffness factor K occurs in four of the six basic equations for the solution, and it might be supposed that any wide variation in the true and assumed values of K would produce a similar

variation in the moment values obtained. It is the purpose of this thesis to determine the effect of widely varying stiffness values upon moments in a typical Vierendeel truss. The case selected was for a 240 foot lift span for a lift bridge across the entrance to a harbor inlet. The span is to carry one lane of highway traffic on each side of a single track standard gauge railway.

FIRST SOLUTION

For the first solution K values were chosen primarily from sample problems accompanying an article on Vierendeel trusses by Mr. Dan Young in the 1937 Proceedings of the A. S. C. E. Whether or not Mr. Young intended that the stiffness values in his problem should closely approximate actual conditions is unknown. On the condition that these values might approximate the trend of moment distribution, our assumed values were made to follow a similar pattern of variation.

SECOND SOLUTION

For the second solution the values of \underline{K} were arrived at by using the moments obtained in the first solution. Since

$$K = \frac{I}{L} = \frac{Mc}{fL}$$

it was possible to solve directly for a value of \underline{K} , inasmuch as members of constant depth (30") were proposed to improve the appearance of the truss and f and L were known values. In this way it was possible to determine the effect of closely approximating moment and stiffness values throughout the truss.

THIRD SOLUTION

For the third solution all K values were assumed to be unity. It was felt that since both moment and stiffness values vary throughout the truss that by holding one of these constant it might be possible to observe the variation of the other. In this way the stiffness values of the second set of computations of any truss might be made to closely approximate the stiffnesses required by the actual moments and thus expedite and simplify the final design of the truss.

FOURTH SOLUTION

For purposes of contrast the stiffness values of the fourth solution were taken exactly opposite to those of the first solution. In other words the same numerical values were used but varying in an inverse order of the first solution. In this way it was hoped to observe the effect of the direction of variations of stiffness values upon the moments computed.

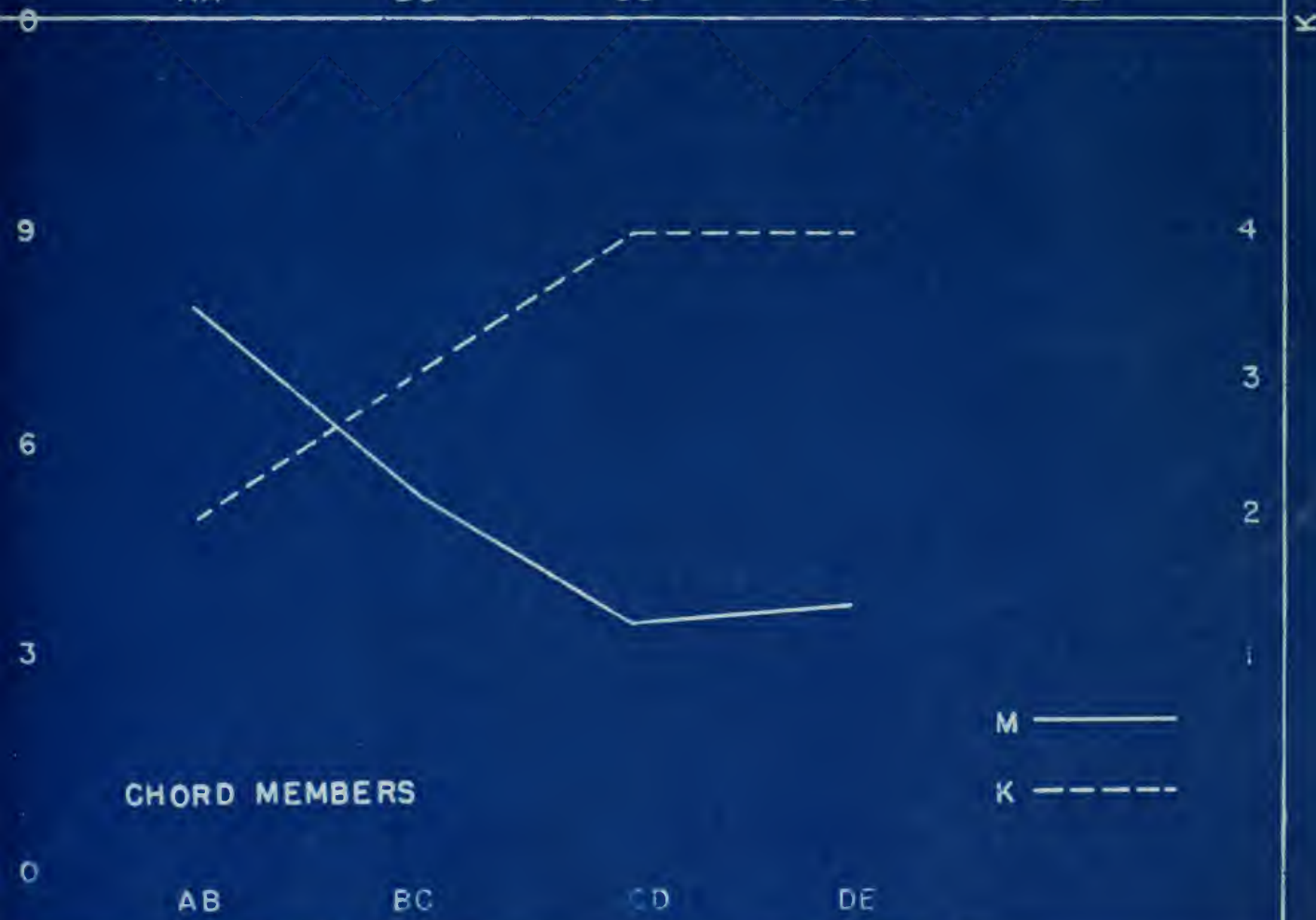
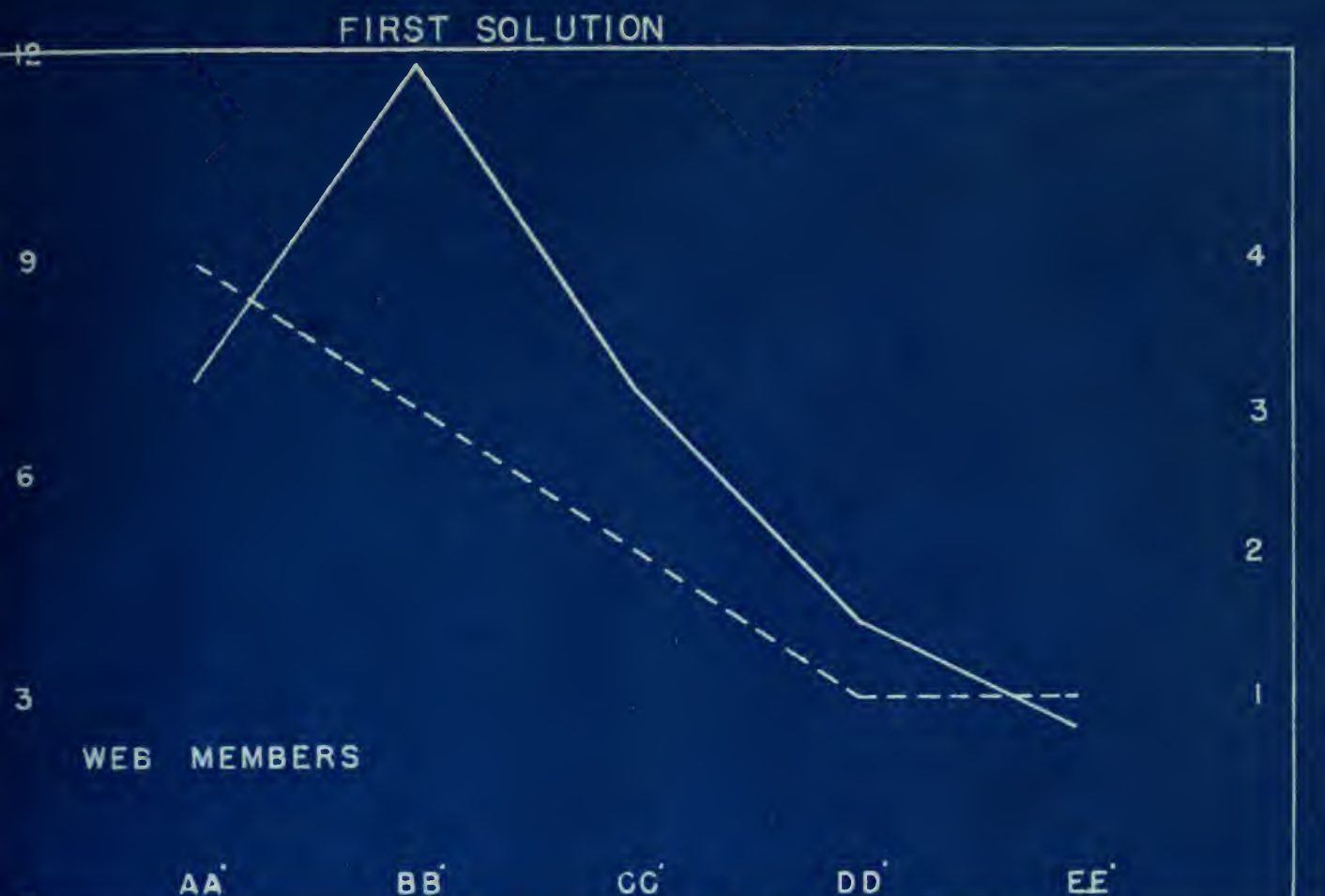
DESIGN MOMENTS

Member	Set 1		Set 2		Set 3		Set 4	
	K	M	K	M	K	M	K	M
AA'	4	7,362	160	7,222	1	7,689	1	7,987
BB'	3	11,745	232	11,762	1	10,600	1	9,030
CC'	2	7,243	136	7,575	1	7,781	2	8,497
DD'	1	4,046	74	4,447	1	5,170	3	5,844
EE'	1	2,593	47	3,000	1	3,282	4	3,435
AB	2	7,958	200	7,212	1	7,689	4	7,987
BC	3	5,360	134	5,492	1	5,465	4	7,329
CD	4	3,548	90	3,529	1	4,043	3	4,436
DE	4	3,790	95	2,877	1	3,020	2	2,986

For purposes of clarity the tabulated results of the moment solutions have been put in graph form on the following pages. Taking web and chord members separately the values of moment and stiffness were plotted for each member for a given solution. The plotted points were then connected in order to indicate the trends of variation of both moment and stiffness. With one exception the moments and stiffnesses as plotted represent the actual values obtained and used in the solution. The one exception is in the case of the second solution. Here the values of K ranged from 200 to 47 and would have been at best unwieldy to plot on the scale adopted. Inasmuch as the numerical value of K appears to affect the solution only in its relative size compared to the other K values the K's for this solution were plotted on a relative scale. By taking $K = 47$ as unity the other K values were reduced to the same relative scale by dividing by 47, greatly simplifying plotting operations and presenting a better method of comparison with the other solutions.

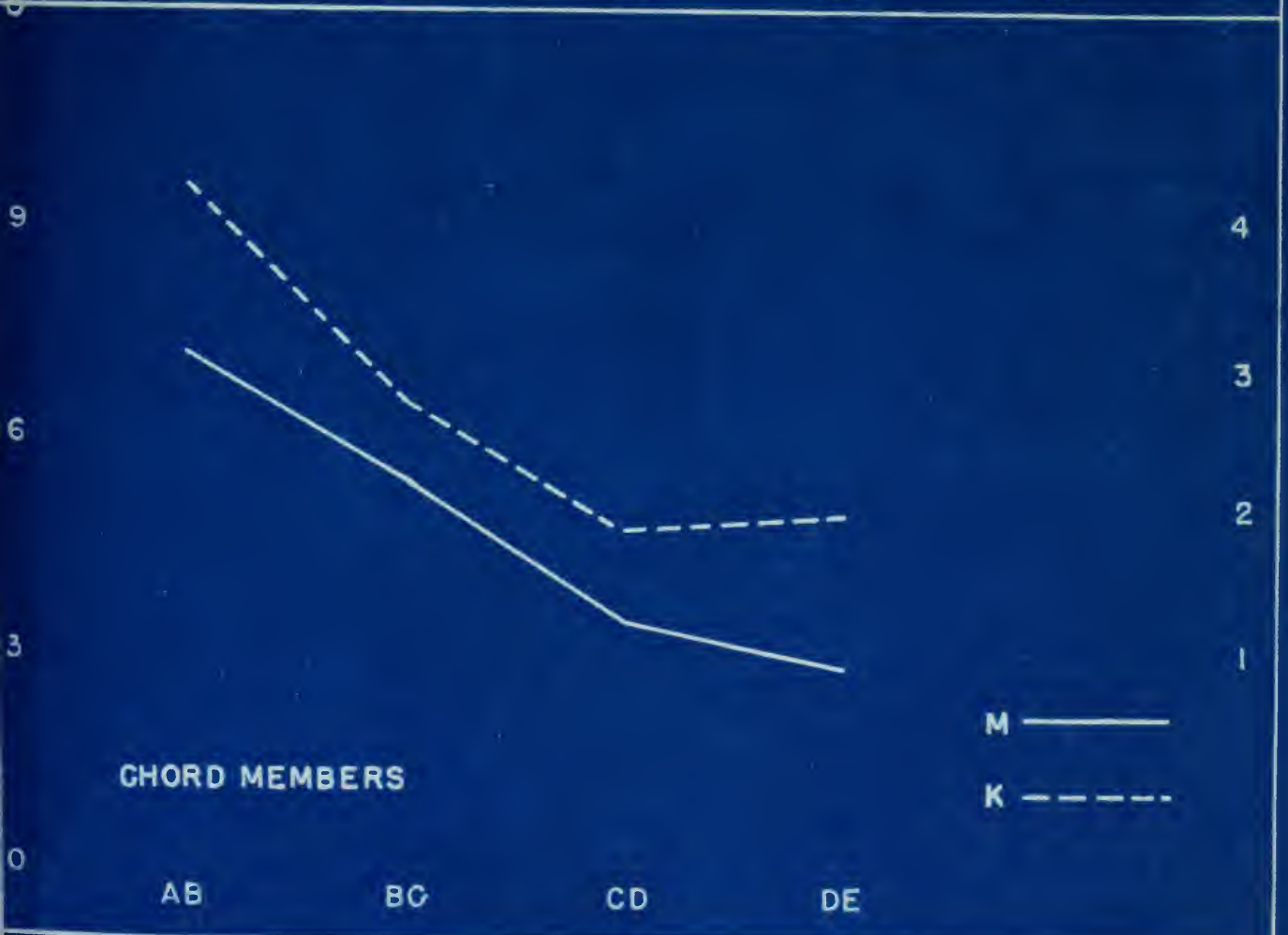
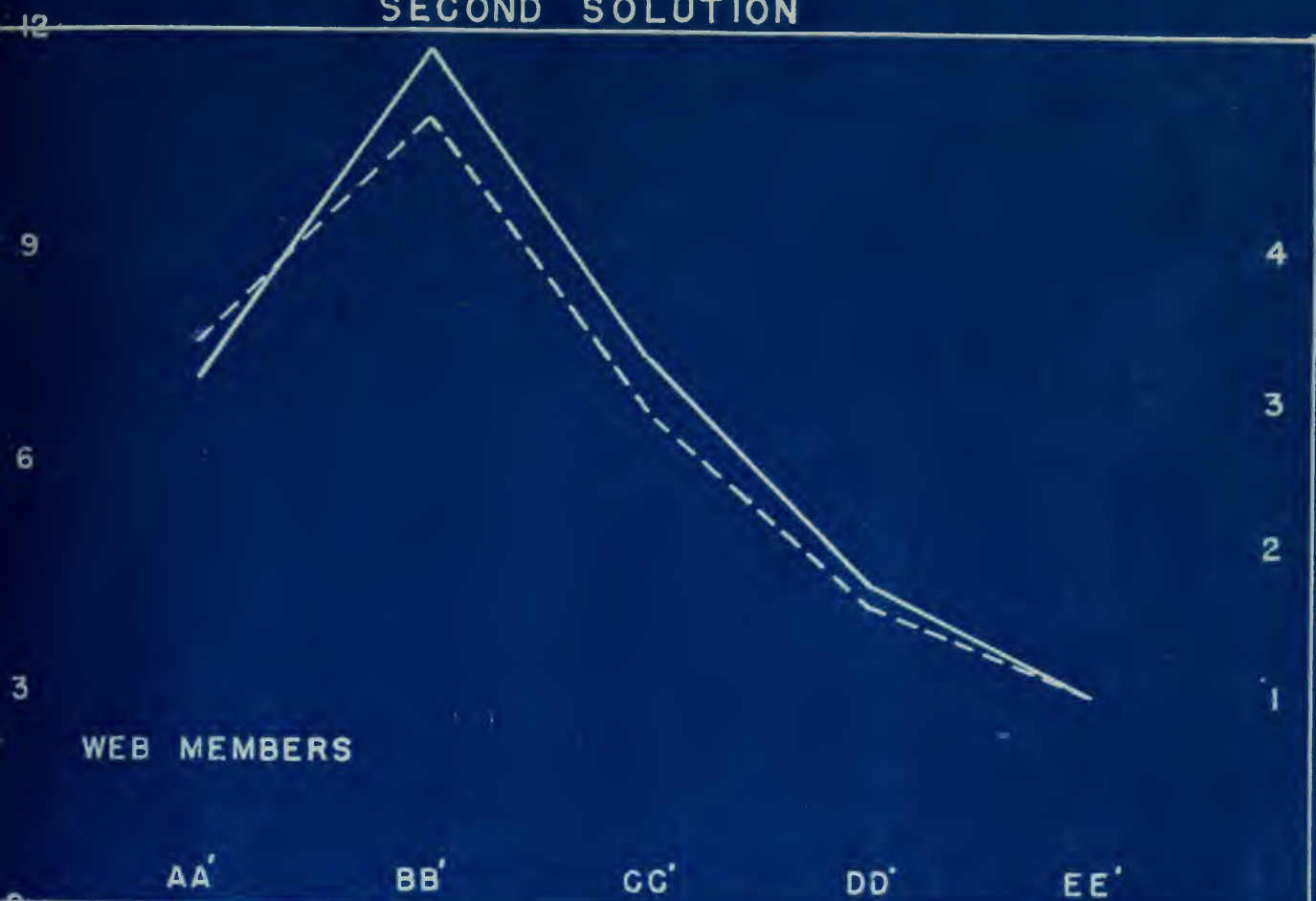
In examining the first solution curves there is little evidence to indicate any direct relationship in the variation of the K values assumed and

the moments obtained. In the case of the web members, CC' and DD' have similar relationships of moment and stiffness. There is an inverse relationship occurring in the case of the other three members. As for the chord members, the inverse relationship exists throughout, high moment values accompanying low stiffness values and vice versa.



The second solution represents a case in which the general trend of moment values closely follows the trend of the stiffness values assumed, with the sole exception of member DE. It is to be noted that there is no proportionality or direct relationship between the values of K and M . While the picture thus presented might seem to indicate a general tendency for moment values to follow stiffness assumptions, it must be remembered that the stiffness values for this solution were obtained directly from the moment values of the previous solution. In effect the moment values have changed but little and by the nature of their assumption it is to be expected that the stiffness values would vary in much the same way as the moment values.

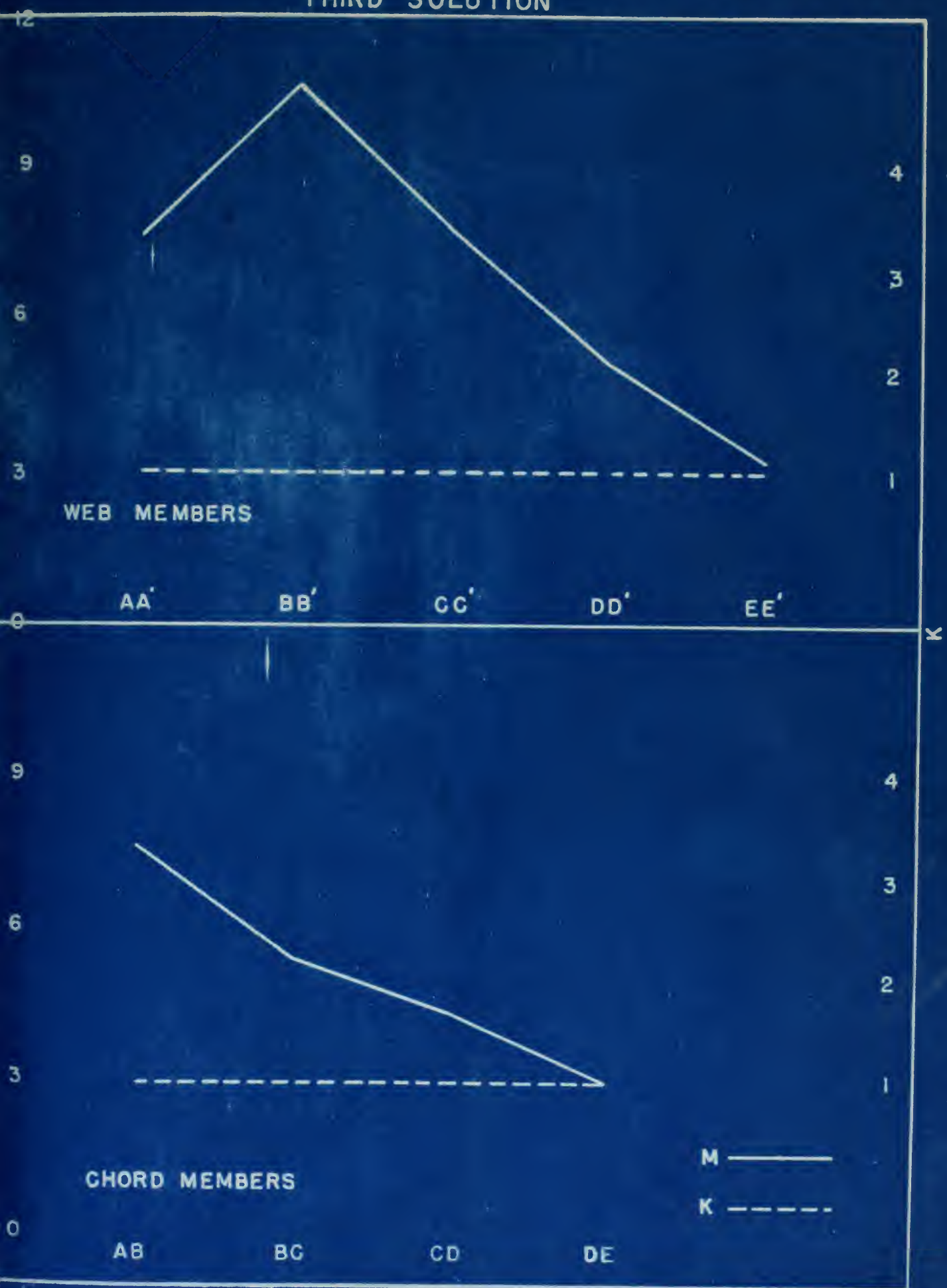
SECOND SOLUTION



The third solution is unique in that it presents an unvarying stiffness curve, all values of K being unity. It is to be noticed that in neither size nor pattern of variation do the moment values differ substantially from the previous solutions. At no place do either of the moment curves display any tendency to follow or parallel the trend of the K values assumed.

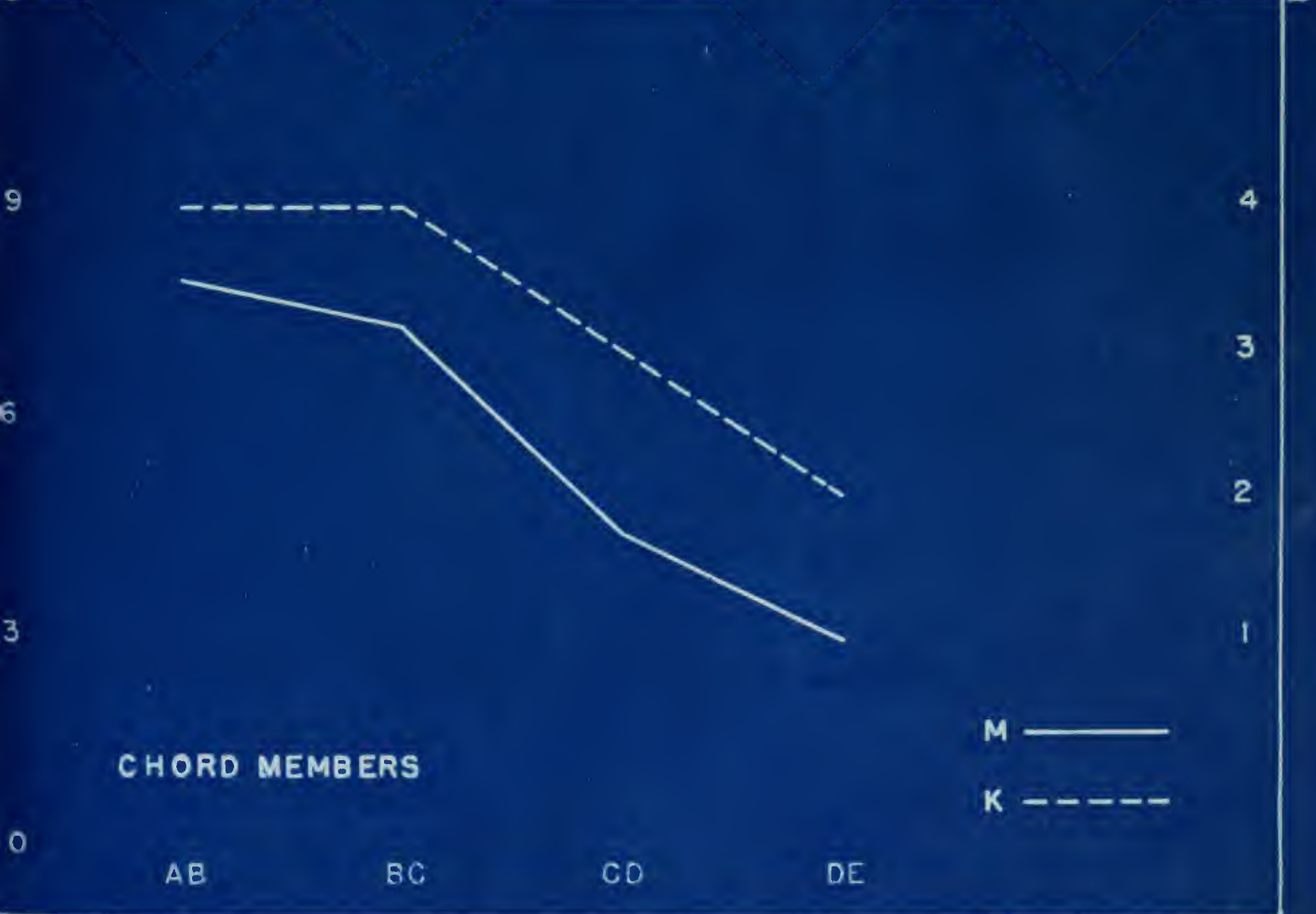
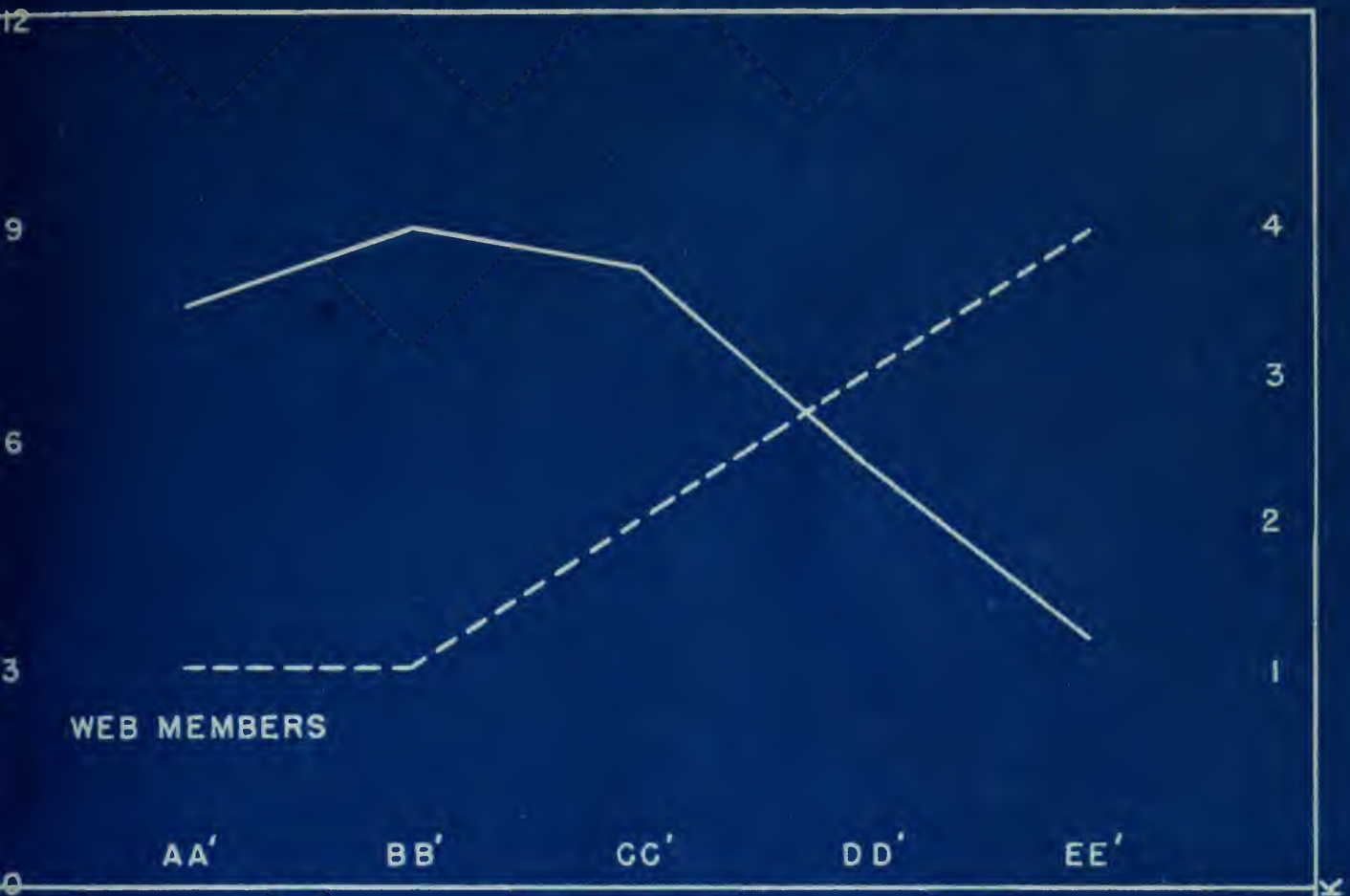
and the other two are the same as the first two.
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The first two are the same as the first two.

THIRD SOLUTION



The fourth solution graph represents a system of stiffness values assumed in an exactly inverse order of those chosen for the first solution. Contrary to the results obtained in that solution we now find that the chord moments tend to follow the same general pattern as their corresponding K values while the web members follow a completely dissimilar path from their K values. As before there is but little variation in either the size or trend of the moments obtained as compared with the resultant moments of the first solution.

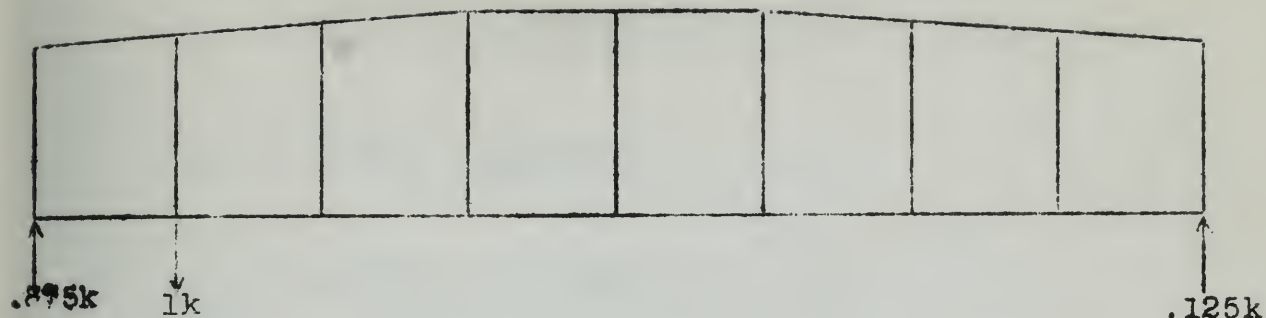
FOURTH SOLUTION



CONCLUSIONS

The results obtained from the four solutions presented show but one common trend, i.e. in no case do the resultant moments of any solution differ widely from those of any other solution. Conversely the stiffness values assumed for any one solution differ widely from those of all other solutions. No relating tendencies are disclosed, a lower stiffness value does not in every case bring a lower moment nor does a higher stiffness value display any significant effect on moments obtained. Likewise a change in the direction of variation of stiffness values seems to have little effect on the moments obtained. Therefore it must be concluded that the size, direction, or degree of variation of assumed values of stiffness of members does not materially affect the moments obtained in the first solution of a Vierendeel truss by this method.

In view of these conclusions it is recommended that in the solution of trusses by this method the first solution be worked with the assumption of all K values as unity. Such an assumption would permit a simpler and quicker solution of the truss with no loss of accuracy.



.0866	.0443	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.875	-.125	-.125	-.125	-.125	-.125	-.125	-.125
26.25	22.50	18.75	15.00	-15.00	-11.25	-7.50	-3.75

Panel 1

$$-Q_A = \frac{(.0942 \times 4 - 2)(.0866 \times 26.25 - .875 \times 30)}{2(2 - .0866)2} = 5.32$$

$$-Q_B = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)} = 6.27$$

$$Q_{R1} = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)2} = 3.14$$

Panel 2

$$-Q_B = \frac{(.0463 \times 3 - 3)(.0443 \times 22.5 - .125 \times 30)}{2(2 - .0443)3} = -1.16$$

$$-Q_C = \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)} = -1.21$$

$$Q_{R2} = \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)3} = -0.40$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 4)(.0482 \times 18.75 + .125 \times 30)}{2(2 - .0482)^4} = -1.16$$

$$-Q_D = \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)} = -1.19$$

$$Q_{R3} = \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - n)^4} = -.30$$

Panel 4

$$-Q_D = \frac{(0 - 4)(0 + .125 \times 30)}{2(2)^4} = -.94$$

$$-Q_E = \frac{(-.125 \times 30 - 0)}{2 \times 2} = -.94$$

$$Q_{R4} = \frac{-.125 \times 30 - 0}{2(2)^4} = -.23$$

Panel 5

$$-Q_E = \frac{-.125 \times 30}{4} = -.94$$

$$-Q_F = \frac{-.125 \times 30}{4} = -.94$$

$$-Q_{R5} = \frac{-.125 \times 30}{4 \times 4} = -.23$$

Panel 6

$$-Q_G = \frac{(.0517 \times 2 - 4) - (.0482 \times 11.25 + .125 \times 30)}{2(2 - .0482)^4} = -.80$$

$$-Q_F = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)} = -.62$$

$$-Q_{R6} = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)^4} = -.20$$

Panel 7

$$-Q_H = \frac{(.0463 \times 3 - 3)(.0443 \times -7.5 - -.125 \times 30)}{2(2 -.0443)^3} = -.083$$

$$-Q_G = \frac{(-.125 \times 30 -.0443 \times -.75)}{2(2 -.0443)} = -0.87$$

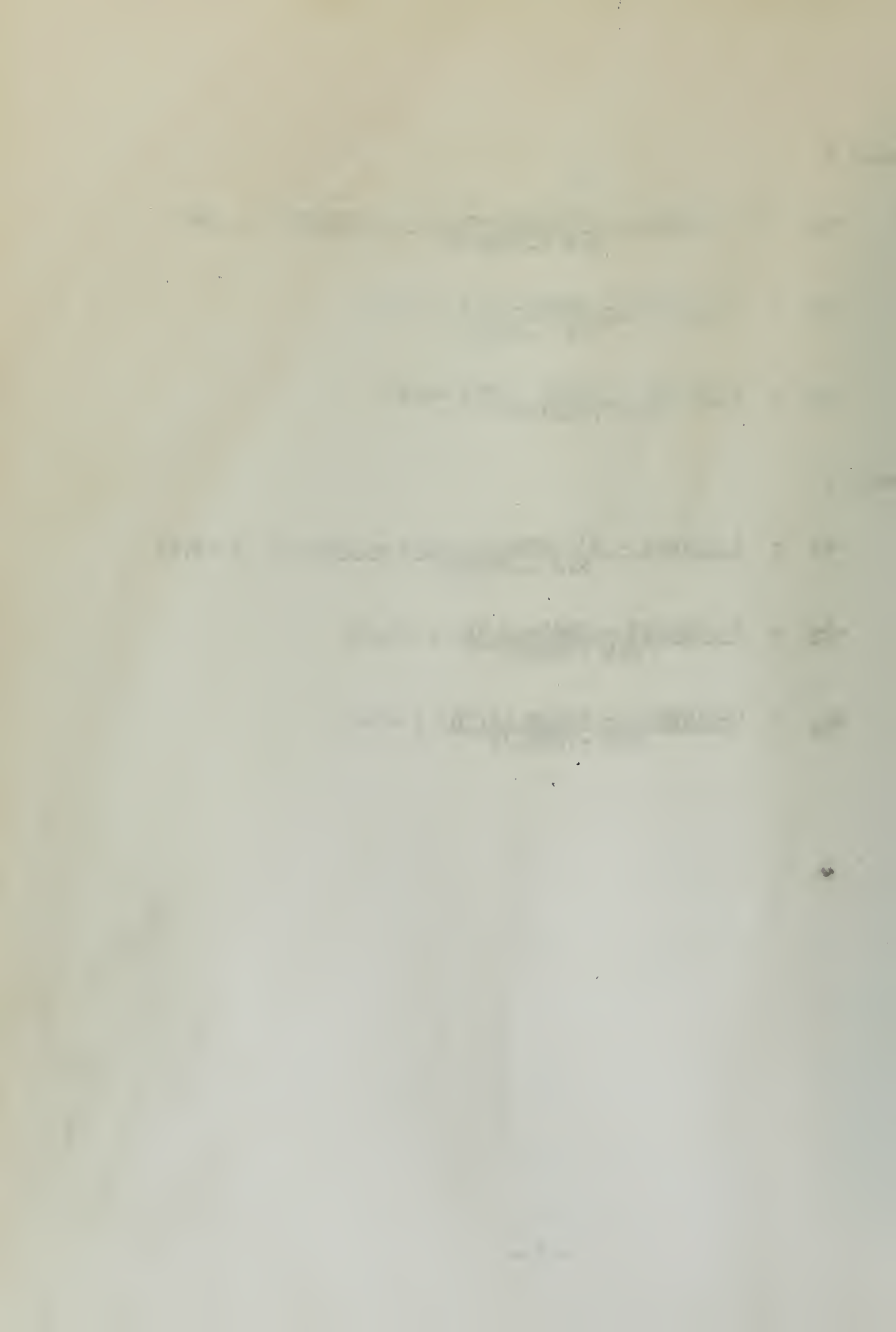
$$-Q_{R7} = \frac{(.125 \times 30 -.0443 \times -.75)}{2(2 -.0443)^5} = -0.29$$

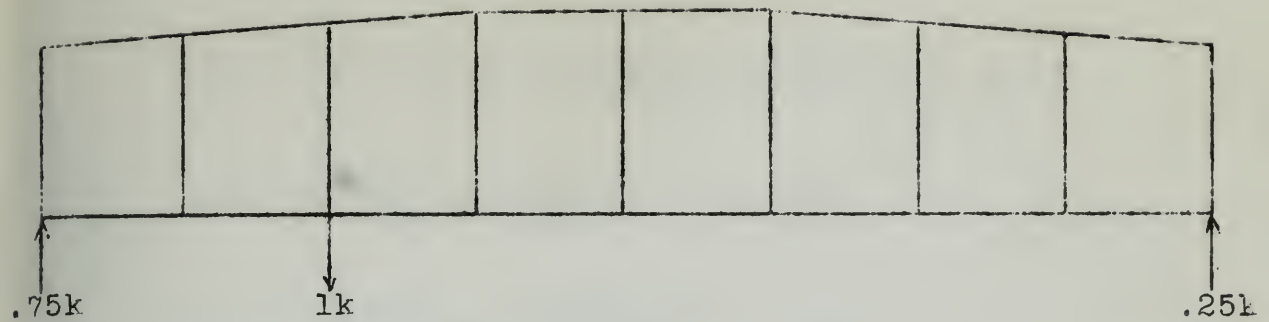
Panel 8

$$-Q_I = \frac{(.0942 \times 4 - 2)(.0861 \times -3.75 - -.125 \times 30)}{2(2 -.0861)^2} = -0.73$$

$$-Q_H = \frac{(-.125 \times 30 -.0861 \times -3.75)}{2(2 -.0861)} = -0.90$$

$$Q_{R8} = \frac{(-.125 \times 30 -.0861 \times -3.75)}{2(2 -.0861)^2} = -0.45$$





.0866	.0443	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.75	.75	.25	-.25	-.25	-.25	-.25	-.25
22.5	45.0	37.5	30.0	-30.0	22.5	-15.0	-7.50

Panel 1

$$-Q_A = \frac{(.0942 \times 4 - 2)(.0866 \times 22.5 - .75 \times 30)}{2(2 - .0866)2} = 4.56$$

$$-Q_B = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R1} = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)2} = 2.69$$

Panel 2

$$-Q_B = \frac{(.0463 \times 3 - 3)(.0443 \times 45 - .75 \times 30)}{2(2 - .0443)3} = 4.98$$

$$-Q_C = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)} = 5.23$$

$$Q_{R2} = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)3} = 1.74$$

$$x_p = \frac{1}{2} \left(x_1 + x_2 + \dots + x_n \right) = \frac{1}{2} \left(x_1 + x_2 + \dots + x_n \right) = \frac{1}{2} \left(x_1 + x_2 + \dots + x_n \right)$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 4)(.0482 \times 37.5 + .25 \times 30)}{2(2 - .0482)4} = -2.33$$

$$-Q_D = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)} = -2.38$$

$$Q_{R3} = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)4} = -.59$$

Panel 4

$$-Q_D = \frac{-4(0 + .25 \times 30)}{4 \times 4} = -1.87$$

$$-Q_E = \frac{(-.25 \times 30 - 0)}{4} = -1.87$$

$$Q_R = \frac{(-.25 \times 30 - 0)}{4 \times 4} = -.47$$

Note: The only term that changes is $(H_1 L_1 - m M_1)$ and since this is doubled when the load is at panel point 2, it is tripled when the load is at panel point 3, etc. The following constants are derived by multiplying those obtained when the load was at PPl by the factors 2, 3, & 4.

Panel 5

$$-Q_L = -1.88$$

$$-Q_F = -1.88$$

$$Q_{R5} = -.47$$

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Panel 6

$$-Q_G = -1.60$$

$$-Q_F = -1.64$$

$$Q_{R6} = -.41$$

Panel 7

$$-Q_H = -1.67$$

$$-Q_G = -1.75$$

$$Q_{R7} = -0.58$$

Panel 8

$$-Q_I = -1.45$$

$$-Q_H = -1.79$$

$$Q_{R8} = -0.90$$

Load at PP3

Panel 5

$$-Q_E = -2.81$$

$$-Q_F = -2.81$$

$$Q_{R5} = -0.70$$

Panel 6

$$-Q_F = -2.47$$

$$-Q_G = -2.40$$

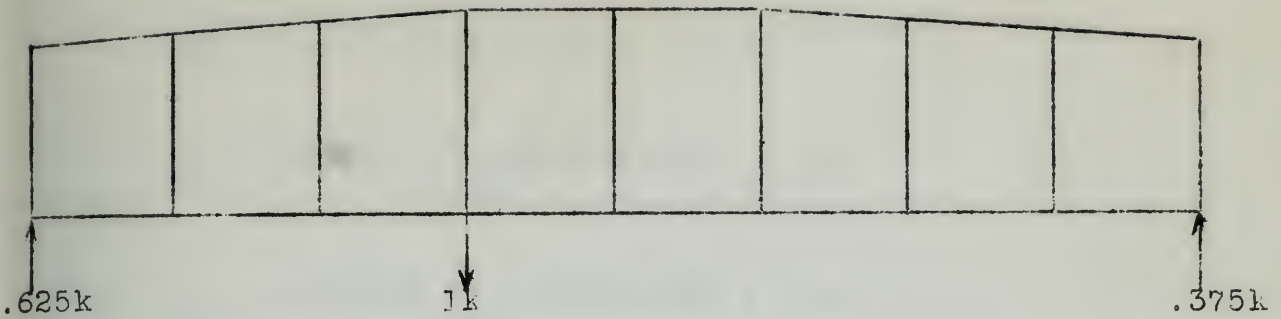
$$Q_{R6} = -0.62$$

Panel 7

$$-Q_G = -2.62$$

$$-Q_H = -2.50$$

$$Q_{R7} = -0.87$$



.0866	.0443	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.625	.625	.625	-.375	-.375	-.375	-.375	-.375
18.75	37.5	56.25	45.0	-45.0	-33.75	-22.5	-11.25

Panel 1

Formulae (110f)&(122a) modified by the application of constants for terms involving only M, n, K₁, and K₂. These constants found and checked in solution for two previous loadings.

$$-Q_A = (-.222)(.0866 \times 18.75 - .625 \times 30) = 3.81$$

$$-Q_B = \frac{(.625 \times 30 - .0866 \times 18.75)}{3.82} = 4.49$$

$$Q_{R1} = \frac{(.625 \times 30 - .0482 \times 56.25)}{7.64} = 2.24$$

Panel 2

$$-Q_B = (-.243)(.0443 \times 37.5 - .625 \times 30) = 4.16$$

$$-Q_C = \frac{(.625 \times 30 - .0443 \times 37.5)}{3.92} = 4.36$$

$$Q_{R2} = \frac{(.625 \times 30 - .0443 \times 37.5)}{11.77} = 1.48$$

[illegible]

$\frac{d}{dt} \left(\frac{\partial L}{\partial \dot{x}} \right) = \frac{\partial L}{\partial x}$

Panel 3

$$-Q_C = (-.25)(.0482 \times 56.25 - .625 \times 30) = 4.02$$

$$-Q_D = \frac{(.625 \times 30 - .0482 \times 56.25)}{(3.90)} = 4.12$$

$$Q_{R3} = \frac{(.625 \times 30 - .0482 \times 56.25)}{15.60} = 1.03$$

Panel 4

$$-Q_D = (-.25)(0 - .375 \times 30) = -2.81$$

$$-Q_E = \frac{(-.375 \times 30 - 0)}{4} = -2.81$$

$$Q_{R4} = \frac{(-.375 \times 30 - 0)}{4 \times 4} = -.70$$

Panel 5

$$-Q_E = -3.75$$

$$-Q_F = -3.75$$

$$Q_{R5} = -0.938$$

Panel 6

$$-Q_F = -3.288$$

$$-Q_G = -3.204$$

$$Q_{R6} = -0.82$$

Panel 7

$$-Q_G = -3.496$$

$$-Q_H = -3.332$$

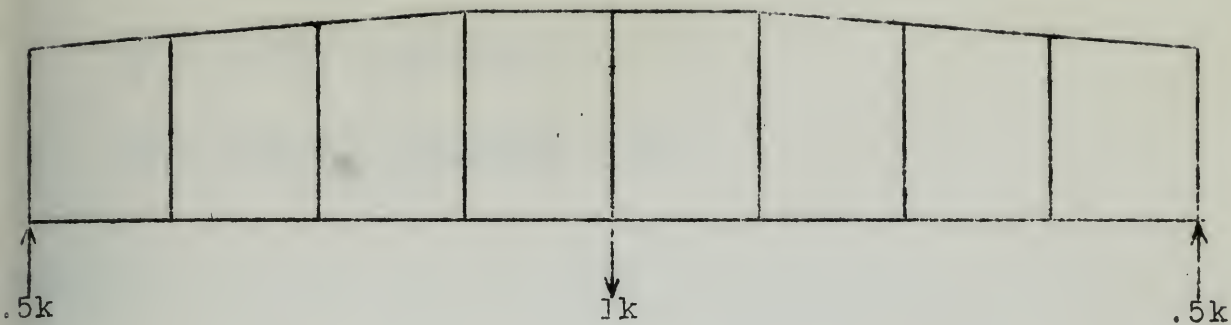
$$Q_{R7} = -1.164$$

Panel 8

$$-Q_H = -3.584$$

$$-Q_I = -2.908$$

$$Q_{R8} = -1.792$$



.0866	.0482	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.5	.5	.5	.5	-.5	-.5	-.5	-.5
15	30	45	60	-60	-45	-30	-15

Panel 1

$$-Q_A = (-.222)(.0866 \times 15 - .5 \times 30) = 3.04$$

$$-Q_B = \frac{(.5 \times 30 - .0866 \times 15)}{3.82} = 3.59$$

$$Q_{R1} = \frac{(.5 \times 30 - .0866 \times 15)}{7.64} = 1.79$$

Panel 2

$$-Q_B = (-.243)(.0443 \times 30 - .5 \times 30) = 3.32$$

$$-Q_C = \frac{(.5 \times 30 - .0443 \times 30)}{3.92} = 3.49$$

$$Q_{R2} = \frac{(.5 \times 30 - .0443 \times 30)}{11.76} = 1.16$$

Panel 3

$$-Q_C = (-.25)(.0482 \times 45 - .5 \times 30) = 3.21$$

$$-Q_D = \left(\frac{.5 \times 30 - .0482 \times 45}{3.90} \right) = 3.30$$

$$Q_{R3} = \left(\frac{.5 \times 30 - .0482 \times 45}{15.60} \right) = .82$$

Panel 4

$$-Q_D = (-.25)(0 - .5 \times 30) = 3.75$$

$$-Q_E = \left(\frac{.5 \times 30 - 0}{4} \right) = 3.75$$

$$Q_{R4} = \left(\frac{.5 \times 30 - 0}{4 \times 4} \right) = .94$$

Panel 5

$$-Q_E = -2.31$$

$$-Q_F = -2.81$$

$$Q_{R5} = -0.70$$

Panel 6

$$-Q_F = -2.47$$

$$-Q_G = -2.40$$

$$Q_{R6} = -0.62$$

Panel 7

$$-Q_G = -2.62$$

$$-Q_H = -2.50$$

$$Q_{R7} = -0.87$$

Panel 8

$$-Q_H = -2.18$$

$$-Q_I = -2.67$$

$$Q_{R8} = -1.34$$

1. The first part of the paper is devoted to a general discussion of the problem.

2. In the second part, we consider the case of a single particle.

3. The third part is devoted to the case of a system of particles.

4. In the fourth part, we consider the case of a continuous medium.

5. The fifth part is devoted to the case of a system of continuous media.

6. In the sixth part, we consider the case of a system of particles and continuous media.

7. The seventh part is devoted to the case of a system of particles and continuous media.

8. In the eighth part, we consider the case of a system of particles and continuous media.

9. The ninth part is devoted to the case of a system of particles and continuous media.

10. In the tenth part, we consider the case of a system of particles and continuous media.

11. The eleventh part is devoted to the case of a system of particles and continuous media.

12. In the twelfth part, we consider the case of a system of particles and continuous media.

13. The thirteenth part is devoted to the case of a system of particles and continuous media.

14. In the fourteenth part, we consider the case of a system of particles and continuous media.

15. The fifteenth part is devoted to the case of a system of particles and continuous media.

INFLUENCE LINES - JOINT CONSTANTS

LOAD AT B

Panel 1

$$\left[1.5x4 + 2 + \frac{(3-.0866)(.0942x4-2)}{2(2-.0866)} \right] A + \left[1 + \frac{(3-.17)(.0942x4-2)}{2(2-.0866)} \right] B = -Q$$

$$6.77A - .25B = 5.32$$

$$\left[2 + 1.5 \times 3 - \frac{(3-.17)2}{2(2-.0866)} \right] B + \left[\frac{2}{3} - \frac{(3-.0866)2}{2(2-.0866)} \right] A = -Q_B$$

$$5.02B - .52A = 6.27$$

Solving Simultaneously

$$A = 0.82$$

$$B = 1.33$$

$$R_1 = \frac{(3-.0866).82 + (3-.17)1.33 + 3.14}{2(2-.0866)} = 4.76$$

Panel 2

$$\left[1.5x3 + 3 + \frac{(3-.0443)(.0463x3-3)}{2(2-.0443)} \right] B + \left[\frac{3}{2} + \frac{(3-.09)(.0463x3-3)}{2(2-.0443)} \right] C = -Q_B$$

$$5.34B - .62C = -1.16$$

$$\left[3 + 1.5x2 - \frac{(3-.0886)3}{2(2-.0443)} \right] C + \left[\frac{3}{2} - \frac{(3-.0443)3}{2(2-.0443)} \right] B = -Q_C$$

$$3.77C - .76B = -1.21$$

Solving Simultaneously

$$B = -.26$$

$$C = -.37$$

$$R_2 = \frac{(3-.0443)(-.26) + (3-.09)(-.37) - .40}{2(2-.0443)} = -.87$$

Panel 3

$$\left[1.5x2 + 4 + \frac{(3 - .0482)(.0507x2 - 4)}{2(2 - .0482)} \right] C + \left[2 + \frac{(3 - .0964)(.0507x2 - 4)}{2(2 - .0482)} \right] D = -Q_C$$

$$4.05 C - .9 D = -1.16$$

$$\left[4 + 1.5 - \frac{(3 - .0964)4}{2(2 - .0482)} \right] D + \left[2 - \frac{(3 - .0482)4}{2(2 - .0482)} \right] C = -Q_D$$

$$2.53 D - 1.02 C = 1.19$$

Solving Simultaneously

$$\begin{aligned} C &= -.43 \\ D &= -.64 \end{aligned}$$

$$R_3 = \frac{(3 - .0482)(-.43) + (3 - .0964)(-.64)}{2(2 - .0482)} - .30 = -1.10$$

Panel 4

$$\left[1.5x1 + 4 + \frac{3(-4)}{4} \right] D + \left[2 + \frac{3(-4)}{4} \right] E = -Q_D$$

$$2.5 D - 1 E = -.94$$

$$\left[4 + 1.5x1 - \frac{3x4}{4} \right] E + \left[2 - \frac{3x4}{4} \right] D = -Q_E$$

$$2.5 E - 1 D = -.94$$

Solving Simultaneously

$$\begin{aligned} D &= -.63 \\ E &= -.63 \end{aligned}$$

$$R_4 = \frac{3(-.63) + 3(-.63)}{4} - .23 = -1.18$$

Panel 5

$$\left[1.5 \times 1 + \frac{4}{4} \right] F - \frac{4}{4} E = -.94$$

$$\left[1.5 \times 1 + \frac{4}{4} \right] E - \frac{4}{4} F = -.94$$

$$E = -.63$$

$$F = -.63$$

$$R_5 = \frac{3}{4} (-.63 - .63) - .23 = -.94 - .23 = -1.17$$

Panel 6

$$\left[1.5 \times 2 + 4 + \frac{(3 - .0482)(.0507 \times 2 - 4)}{2(2 - .0482)} \right] G$$

$$+ \left[\frac{4}{2} + \frac{(3 - 2 \times .0482)(.0507 \times 2 - 4)}{2(2 - .0482)} \right] F = -.80$$

$$4.06 G - 0.89 F = -.80$$

$$\left[4 + 1.5 \times 1 - \frac{(3 - 2 \times .0482)4}{2(2 - .0482)} \right] F + \left[\frac{4}{2} - \frac{(3 - .0482)4}{2(2 - .0482)} \right] G = -.82$$

$$2.53 F - 1.02 G = -.82$$

Solving Simultaneously

$$F = -.47$$

$$G = -.30$$

$$R_6 = \frac{-(3 - .0482) \times .30 - (3 - 2 \times .0482) \times .47}{2(2 - .0482)} - .21 = -.78$$

11
[Faint, illegible text]

[Faint, illegible text]

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[Faint, illegible text]

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[Faint, illegible text]

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Panel 7

$$\left[1.5 \times 3 + 3 + \frac{(3-.0443)(.0463 \times 3 - 3)}{2(2-.0443)} \right] H$$

$$+ \left[\frac{3}{2} + \frac{(3-2 \times .0443)(.0463 \times 3 - 3)}{2(2-.0443)} \right] G = -0.83$$

$$5.34 H - .62 G = -.83$$

$$\left[3 + 1.5 \times 2 - \frac{(3-2 \times .0443)3}{2(2-.0443)} \right] G + \left[\frac{3}{2} - \frac{(3-.0433)3}{2(2-.0433)} \right] H = -.87$$

$$3.77 G - .76 H = -.87$$

Solving Simultaneously

$$G = -.27$$

$$H = -.19$$

$$R_7 = - \frac{(3-.0443) \times .19 + (3-2 \times .0443) \times -.27}{2(2-.0443)} - 0.29 = -.63$$

Panel 8

$$\left[1.5 \times 4 + 2 + \frac{(3-.0866)(.0942 \times 4 - 2)}{2(2-.0866)} \right] I + \left[\frac{2}{2} + \frac{(3-2 \times .0866)(.0942 \times 4 - 2)}{2(2-.0866)} \right] H$$

$$= -.73$$

$$6.77 I - .20 H = -.73$$

$$\left[2 + 1.5 \times 3 - \frac{(3-2 \times .0866)2}{2(2-.0866)} \right] H + \left[\frac{2}{2} - \frac{(3-.0866)2}{2(2-.0866)} \right] I$$

$$5.02 H - .52 I = -.49$$

Solving Simultaneously

$$H = -0.21$$

$$I = -0.11$$

$$R_8 = - \frac{(3-.0866) \times .11 - (3-2 \times .0866) \times -.21}{2(2-.0861)} - 0.49 = .73$$

1. The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \frac{1}{2} \left(f\left(\frac{x}{2}\right) + f\left(\frac{x+1}{2}\right) \right)$$

where $f(x)$ is a continuous function on the interval $[0, 1]$.

It is easy to see that the function $f(x)$ is symmetric about the point $x = \frac{1}{2}$, i.e., $f(x) = f(1-x)$.

$$f\left(\frac{1}{2}\right) = \frac{1}{2} \left(f\left(\frac{1}{4}\right) + f\left(\frac{3}{4}\right) \right)$$

$$f\left(\frac{1}{4}\right) = \frac{1}{2} \left(f\left(\frac{1}{8}\right) + f\left(\frac{5}{8}\right) \right)$$

$$f\left(\frac{1}{8}\right) = \frac{1}{2} \left(f\left(\frac{1}{16}\right) + f\left(\frac{9}{16}\right) \right)$$

and so on. It follows that the function $f(x)$ is a constant function, i.e., $f(x) = c$ for all $x \in [0, 1]$.

where c is a constant.

2.

$$f(x) = \frac{1}{2} \left(f\left(\frac{x}{2}\right) + f\left(\frac{x+1}{2}\right) \right) \quad (1)$$

Let us assume that $f(x)$ is a constant function, i.e., $f(x) = c$ for all $x \in [0, 1]$.

$$c = \frac{1}{2} \left(c + c \right) \quad (2)$$

$$c = c$$

which is true for any constant c .

$$f\left(\frac{1}{2}\right) = \frac{1}{2} \left(f\left(\frac{1}{4}\right) + f\left(\frac{3}{4}\right) \right) \quad (3)$$

$$c = \frac{1}{2} \left(c + c \right)$$

which is true for any constant c .

3.

$$f(x) = \frac{1}{2} \left(f\left(\frac{x}{2}\right) + f\left(\frac{x+1}{2}\right) \right) \quad (4)$$

Influence Lines - Joint Constants

Load at C

Panel 1

$$6.77A - .2 B = 4.56$$

$$-.52A + 5.02B = 5.38$$

Solving Simultaneously

$$A = .71$$

$$B = 1.14$$

$$R_1 = \frac{(3 - .0866) \cdot .71 + (3 - .17) 1.14}{2(2 - .0866)} + 2.69 = 4.07$$

Panel 2

$$5.34B - .62C = 4.98$$

$$3.77C - .76B = 5.23$$

Solving Simultaneously

$$B = 1.14$$

$$C = 1.62$$

$$R_2 = \frac{(3 - .0443)B + (3 - .0886)C}{2(2 - .0443)} + 1.76 = 3.80$$

Panel 3

$$4.05C - .9 D = -2.23$$

$$2.53D - 1.02C = -1.19$$

Solving Simultaneously

$$C = -.72$$

$$D = -.76$$

$$R_3 = \frac{(3 - .0482)(-.72) + (3 - .0964)(-.76)}{2(2 - .0482)} - .59 = -1.70$$

Panel 4

$$2.5D - 1E = -1.87$$

$$2.5E - 1D = -1.87$$

Solving Simultaneously

$$D = -1.25$$

$$E = -1.25$$

$$R_4 = \frac{3(-1.25) + 3(-1.25)}{4} - .47 = -2.34$$

Panel 5

$$E = -1.25$$

$$F = -1.25$$

$$R_5 = -2.34$$

Panel 6

$$F = -0.94$$

$$G = -0.60$$

$$R_6 = -1.56$$

Panel 7

$$G = -0.54$$

$$H = -0.37$$

$$R_7 = -1.27$$

Panel 8

$$H = -0.41$$

$$I = -0.23$$

$$R_8 = -1.45$$

Influence Lines - Joint Constants

Load at D

Panel 1

$$6.77A - .2 B = 3.81$$

$$-.52A + 5.02B = 4.49$$

Solving Simultaneously

$$A = .59$$

$$B = .96$$

$$R_1 = \frac{(3 - .0866) .59 + (3 - .17) .96}{2(2 - .0866)} + 2.24 = 3.40$$

Panel 2

$$5.34B - .62C = 4.16$$

$$3.77C - .76B = 4.36$$

Solving Simultaneously

$$B = .94$$

$$C = 1.34$$

$$R_2 = \frac{(3 - .0443)B + (3 - .0886)C}{2(2 - .0443)} + 1.48 = 3.18$$

Panel 3

$$4.05C - .9D = 4.02$$

$$2.53D - 1.02C = 4.12$$

Solving Simultaneously

$$C = 1.49$$

$$D = 2.23$$

$$R_3 = \frac{(3 - .0482)1.49 + (3 - .0964)2.23}{2(2 - .0482)} + 1.03 = 3.81$$

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FROM

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Panel 4

$$2.5D - 1E = -2.81$$

$$2.5E - 1D = -2.81$$

Solving Simultaneously

$$D = -1.87$$

$$E = -1.87$$

$$R_4 = \frac{3(-1.87) + 3(-1.87)}{4} + .70 = -3.51$$

Panel 5

$$E = -1.88$$

$$F = -1.88$$

$$R_5 = -3.52$$

Panel 6

$$F = -1.41$$

$$G = -0.90$$

$$R_6 = -2.34$$

Panel 7

$$G = -0.81$$

$$H = -0.56$$

$$R_7 = -1.90$$

Panel 8

$$H = -0.62$$

$$I = -0.34$$

$$R_8 = -2.18$$

Influence Lines - Joint Constants

Load at E

Panel 1

$$6.77A - .2B = 3.04$$

$$-.52A + 5.02B = 3.59$$

Solving Simultaneously

$$A = .47$$

$$B = .76$$

$$R_1 = \frac{(3 - .0866).47 + (3 - .17).76}{2(2 - .0866)} + 1.79 = 2.71$$

Panel 2

$$5.34B - .62C = 3.32$$

$$3.77C - .76B = 3.49$$

Solving Simultaneously

$$B = .75$$

$$C = 1.08$$

$$R_2 = \frac{(3 - .0443)B + (3 - .0866)C}{2(2 - .0433)} + 1.16 = 2.53$$

Panel 3

$$4.05C - .9D = 3.21$$

$$2.53D - 1.02C = 3.30$$

Solving Simultaneously

$$C = 1.19$$

$$D = 1.78$$

$$R_3 = \frac{(3 - .0482)1.19 + (3 - .0964)1.78}{2(2 - .0482)} + .82 = 3.04$$

Panel 4

$$2.5D - 1E = 3.75$$

$$2.5E - 1D = 3.75$$

Solving Simultaneously

$$D = 2.5$$

$$E = 2.5$$

$$R_4 = \frac{3(2.5) + 3(2.5)}{4} + .94 = 4.69$$

Panel 5

$$E = -2.50$$

$$F = -2.50$$

$$R_5 = -4.69$$

Panel 6

$$F = -1.88$$

$$G = -1.20$$

$$R_6 = -3.12$$

Panel 7

$$G = -1.08$$

$$H = -.75$$

$$R_7 = 2.53$$

Panel 8

$$H = -.83$$

$$I = -.45$$

$$R_8 = -2.91$$

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations (1) and (2) under the assumption that the functions $f_i(x)$ and $g_j(x)$ are continuous and satisfy certain conditions.

2. In the second part, we consider the case when the functions $f_i(x)$ and $g_j(x)$ are piecewise continuous and the system of equations (1) and (2) is solved in the sense of Carathéodory.

3. Finally, in the third part, we study the question of the uniqueness of the solution of the system of equations (1) and (2) under the assumption that the functions $f_i(x)$ and $g_j(x)$ are continuous and satisfy certain conditions.

4. The results of the paper are summarized in the following theorem: Let the functions $f_i(x)$ and $g_j(x)$ be continuous and satisfy the conditions

1. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

2. $f_i(x)$ and $g_j(x)$ are bounded on D .

3. $f_i(x)$ and $g_j(x)$ are piecewise continuous in x and t on the domain D .

4. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

5. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

6. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

7. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

8. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

9. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

10. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

11. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

12. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

13. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

14. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

15. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

16. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

17. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

18. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

19. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

20. $f_i(x)$ and $g_j(x)$ are continuous in x and t on the domain D .

Influence Lines - Moment Determination

Load at B

Panel 1

$$M_{AB} = 2\left(.82 + \frac{1.33}{2} - 4.76\right) = -6.56$$

$$M_{BA} = 2\left(1.33 + \frac{.82}{2} - 4.76\right) = -6.04$$

Panel 2

$$M_{BC} = 3\left(-.26 - \frac{.37}{2} + .87\right) = +1.29$$

$$M_{CB} = 3\left(-.37 - \frac{.26}{2} + .87\right) = +1.11$$

Panel 3

$$M_{CD} = 4\left(-.43 - \frac{.64}{2} + 1.10\right) = +1.40$$

$$M_{DC} = 4\left(-.64 - \frac{.43}{2} + 1.10\right) = +1.10$$

Panel 4

$$M_{DE} = 4\left(-.63 - \frac{.63}{2} + 1.18\right) = +.96$$

$$M_{ED} = 4\left(-.63 - \frac{.63}{2} + 1.18\right) = +.96$$

Panel 5

$$M_{EF} = 4\left(-.63 - \frac{.63}{2} + 1.17\right) = +0.94$$

$$M_{FE} = 4\left(-.63 - \frac{.63}{2} + 1.17\right) = +0.94$$

Panel 6

$$M_{FG} = 4(-.47 - \frac{.30}{2} + .78) = +0.64$$

$$M_{GF} = 4(-.30 - \frac{.47}{2} + .78) = +0.98$$

Panel 7

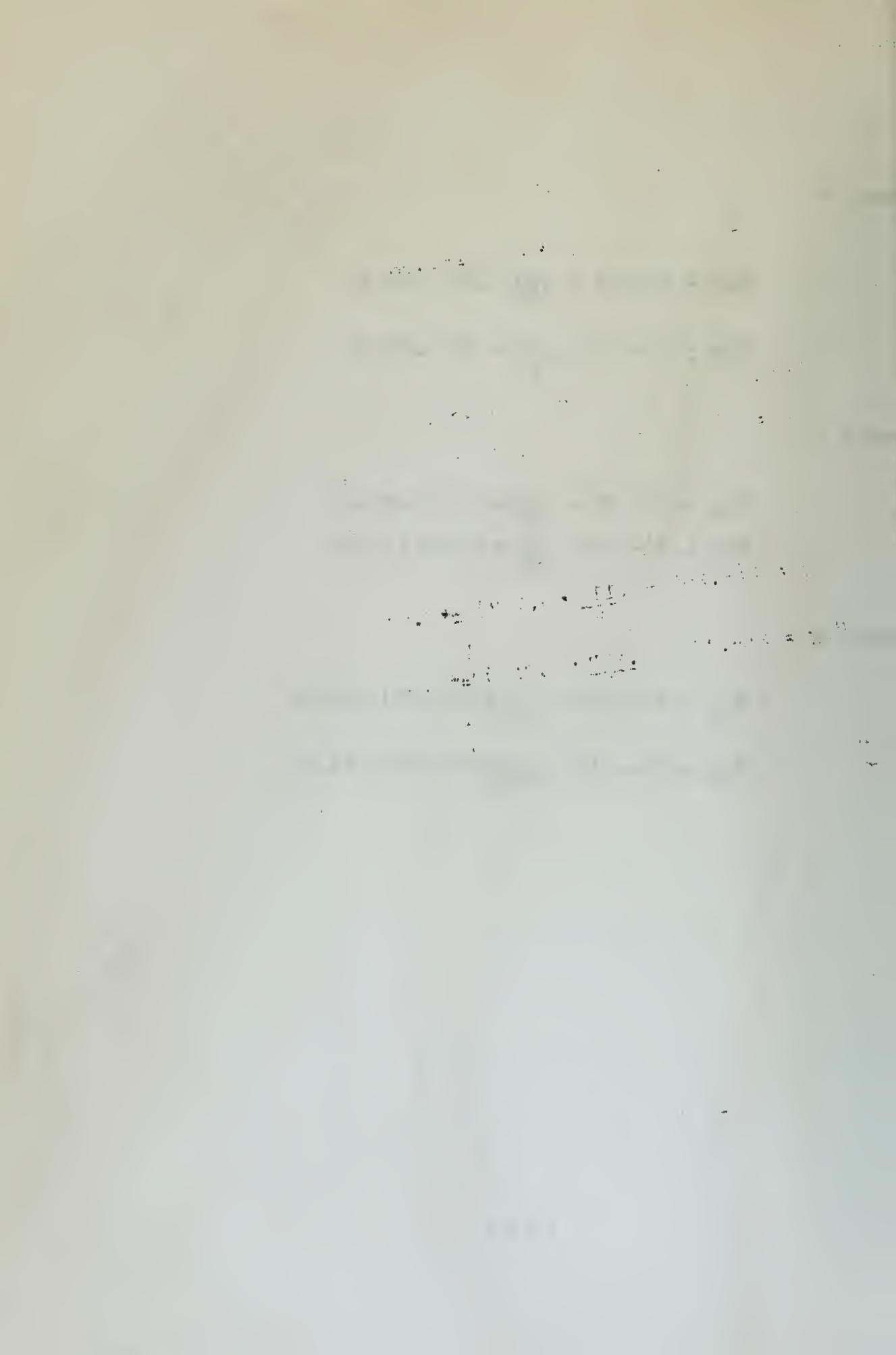
$$M_{GH} = 3(-.27 - \frac{.19}{2} + 0.63) = +0.81$$

$$M_{HG} = 3(-.19 - \frac{.27}{2} + 0.63) = +0.93$$

Panel 8

$$M_{HI} = 2(-.207 - \frac{.113}{2} + 0.727) = +0.93$$

$$M_{IH} = 2(-.113 - \frac{.207}{2} + 0.727) = +1.02$$



Influence Lines - Moment Determination

Load at C

Panel 1

$$M_{AB} = 2\left(\cancel{.71} + \frac{1.14}{2} - 4.07\right) = -5.58$$

$$M_{BA} = 2\left(1.14 + \frac{\cancel{.71}}{2} - 4.07\right) = -5.16$$

Panel 2

$$M_{BC} = 3\left(1.14 + \frac{1.62}{2} - 3.80\right) = -5.55$$

$$M_{CB} = 3\left(1.62 + \frac{1.14}{2} - 3.80\right) = -4.83$$

Panel 3

$$M_{CD} = 4\left(\cancel{-.72} - \frac{.76}{2} + 1.70\right) = \cancel{+}2.40$$

$$M_{DC} = 4\left(\cancel{-.76} - \frac{.72}{2} + 1.70\right) = \cancel{+}2.32$$

Panel 4

$$M_{DE} = 4\left(\cancel{-1.25} - \frac{1.25}{2} + 2.34\right) = \cancel{+}1.88$$

$$M_{ED} = 4\left(\cancel{-1.25} - \frac{1.25}{2} + 2.34\right) = \cancel{+}1.88$$

Panel 5

$$M_{EF} = 1.88$$

$$M_{FE} = 1.88$$

Panel 6

$$M_{FG} = 1.29$$

$$M_{GF} = 1.96$$

Panel 7

$$M_{GH} = 1.62$$

$$M_{HG} = 1.87$$

Panel 8

$$M_{HI} = 1.85$$

$$M_{IH} = 2.04$$

Influence Lines - Moment Determination

Load at D

Panel 1

$$M_{AB} = 2(.59 + \frac{.96}{2} - 3.40) = -4.66$$

$$M_{BA} = 2(.96 + \frac{.59}{2} - 3.40) = -4.30$$

Panel 2

$$M_{BC} = 3(.94 + \frac{1.34}{2} - 3.18) = -4.71$$

$$M_{CB} = 3(1.34 + \frac{.94}{2} - 3.18) = -4.11$$

Panel 3

$$M_{CD} = 4(1.49 + \frac{2.23}{2} - 3.81) = -4.84$$

$$M_{DC} = 4(2.23 + \frac{1.49}{2} - 3.81) = -3.36$$

Panel 4

$$M_{DE} = 4(-1.87 - \frac{1.87}{2} + 3.51) = +2.84$$

$$M_{ED} = 4(-1.87 - \frac{1.87}{2} + 3.51) = +2.84$$

Panel 5

$$M_{EF} = 2.81$$

$$M_{FE} = 2.81$$

Panel 6

$$M_{FG} = 1.93$$

$$M_{GF} = 2.94$$

Panel 7

$$M_{GH} = 2.43$$

$$M_{HG} = 2.80$$

Panel 8

$$M_{HI} = 2.78$$

$$M_{IH} = 3.06$$

PHYSICS 101

LECTURE 1

MECHANICS

1.1

INTRODUCTION

1.2

1.3

1.4

1.5

1.6

1.7

1.8

1.9

1.10

1.11

1.12

1.13

1.14

1.15

1.16

1.17

1.18

Influence Lines - Moment Determination

Load at E

Panel 1

$$M_{AB} = 2(.47 + \frac{.76}{2} - 2.79) = -3.88$$

$$M_{BA} = 2(.76 + \frac{.47}{2} - 2.79) = -3.60$$

Panel 2

$$M_{BC} = 3(.75 + \frac{1.08}{2} - 2.53) = -3.72$$

$$M_{CB} = 3(1.08 + \frac{.75}{2} - 2.53) = -3.24$$

Panel 3

$$M_{CD} = 4(1.19 + \frac{1.78}{2} - 3.04) = -3.84$$

$$M_{DC} = 4(1.78 + \frac{1.19}{2} - 3.04) = -2.68$$

Panel 4

$$M_{DE} = 4(2.5 + \frac{2.5}{2} - 4.69) = -3.76$$

$$M_{ED} = 4(2.5 + \frac{2.5}{2} - 4.69) = -3.76$$

Panel 5

$$M_{EF} = 3.75$$

$$M_{FE} = 3.75$$

Panel 6

$$M_{FG} = 2.58$$

$$M_{GF} = 3.92$$

Panel 7

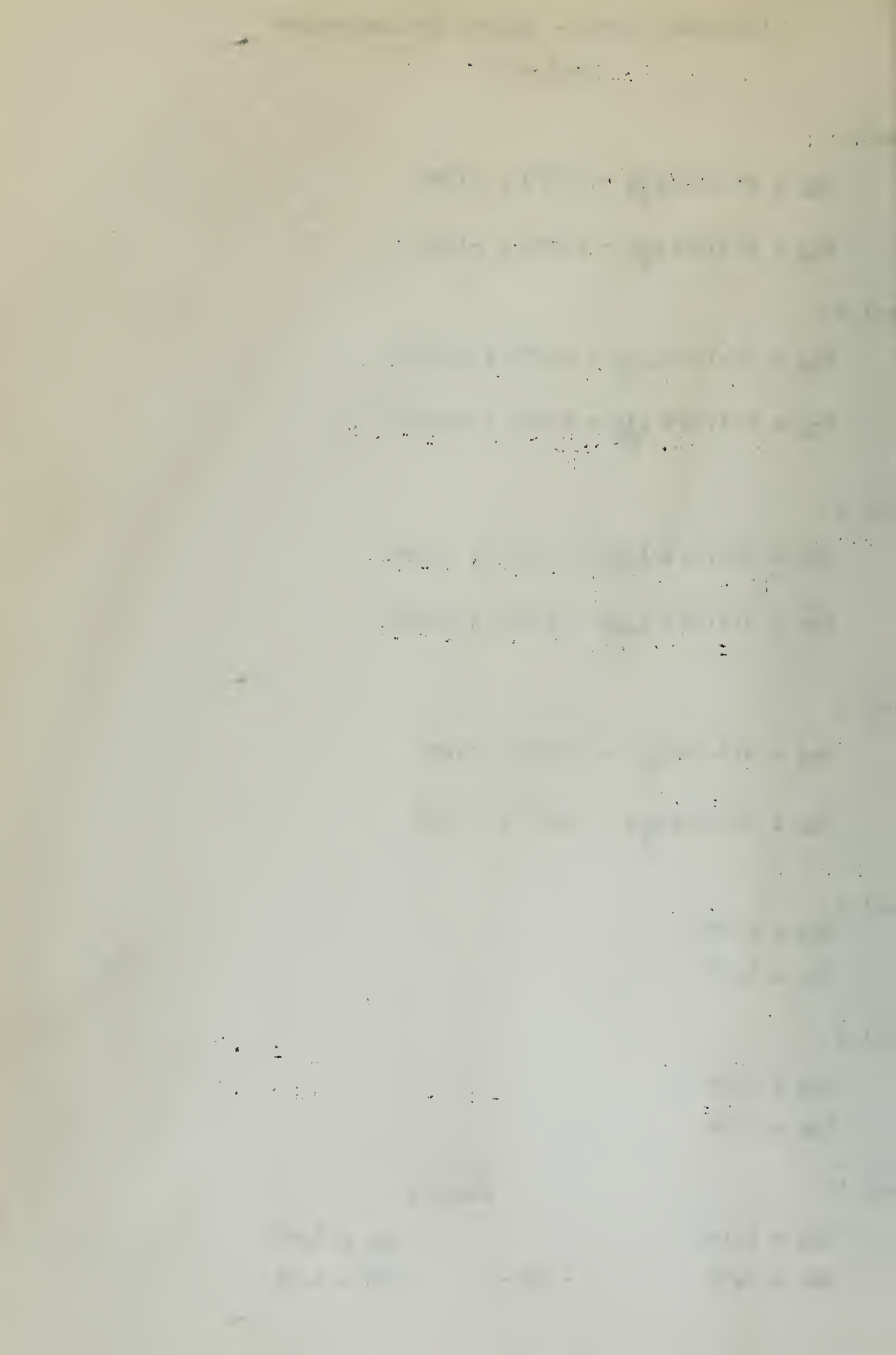
$$M_{GH} = 3.24$$

$$M_{HG} = 3.73$$

Panel 8

$$M_{HI} = 3.60$$

$$M_{IH} = 4.08$$



First Moment Corrections - Load at B

Panel 1

$$6.77A - .20B = 0 \quad A = -.01$$

$$-0.52A + 5.02B = -1.29 \quad B = -.25$$

$$R_1 = \frac{-2.91 \times .01 - 2.83 \times .25}{3.83} = -.19$$

$$M_{AB} = 2(-.01 - \frac{.25}{2} + .19) = .12$$

$$M_{BA} = 2(-.25 - \frac{.01}{2} + .19) = -.12$$

Panel 2

$$5.34B - .63C = 6.04 \quad B = 1.11$$

$$-0.77B + 3.77C = -1.40 \quad C = -0.14$$

$$R_2 = \frac{2.96 \times 1.11 - 2.91 \times .14}{3.91} = .74$$

$$M_{BC} = 2(1.11 - \frac{.14}{2} + 0.74) = .60$$

$$M_{CB} = 2(-.14 + \frac{1.11}{2} + 0.74) = -.64$$

Panel 3

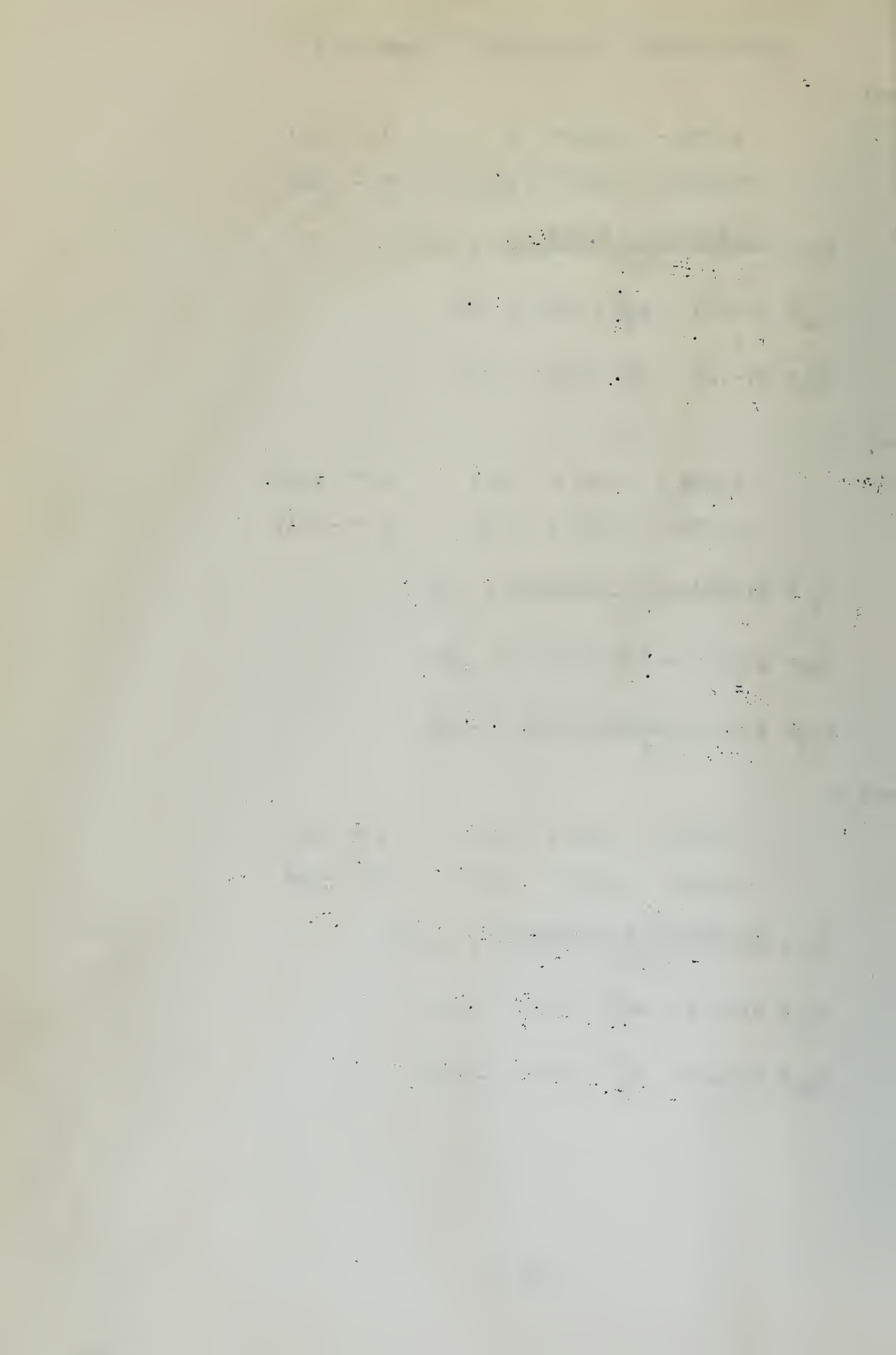
$$4.06C - .89D = -1.11 \quad C = -.39$$

$$-1.02C + 2.53D = -.96 \quad D = -.54$$

$$R_3 = \frac{-2.95 \times .39 - 2.90 \times .54}{3.90} = -.70$$

$$M_{CD} = 3(-.39 - \frac{.54}{2} + .70) = .12$$

$$M_{DC} = 3(-.54 - \frac{.39}{2} + .70) = -.12$$



Panel 4

$$\begin{aligned} 2.5 D - E &= -1.10 \\ -0 + 2.5 E &= -.96 \\ D &= -.71 \\ E &= -.67 \end{aligned}$$

$$R_4 = \frac{3}{4} (-.67 - .71) = -1.03$$

$$M_{DE} = 4(-.71 - \frac{.67}{2} + 1.03) = -.08$$

$$M_{ED} = 4(-.67 - \frac{.71}{2} + 1.03) = .04$$

Panel 5

$$\begin{aligned} 2.5 E - F &= -.64 \\ -E + 2.5 F &= -.96 \\ E &= -.49 \\ F &= -.58 \end{aligned}$$

$$R_5 = \frac{3}{4} (-.58 - .49) = -.80$$

$$M_{EF} = 4(-.49 - \frac{.58}{2} + .80) = .08$$

$$M_{FE} = 4(-.58 - \frac{.49}{2} + .80) = -.12$$

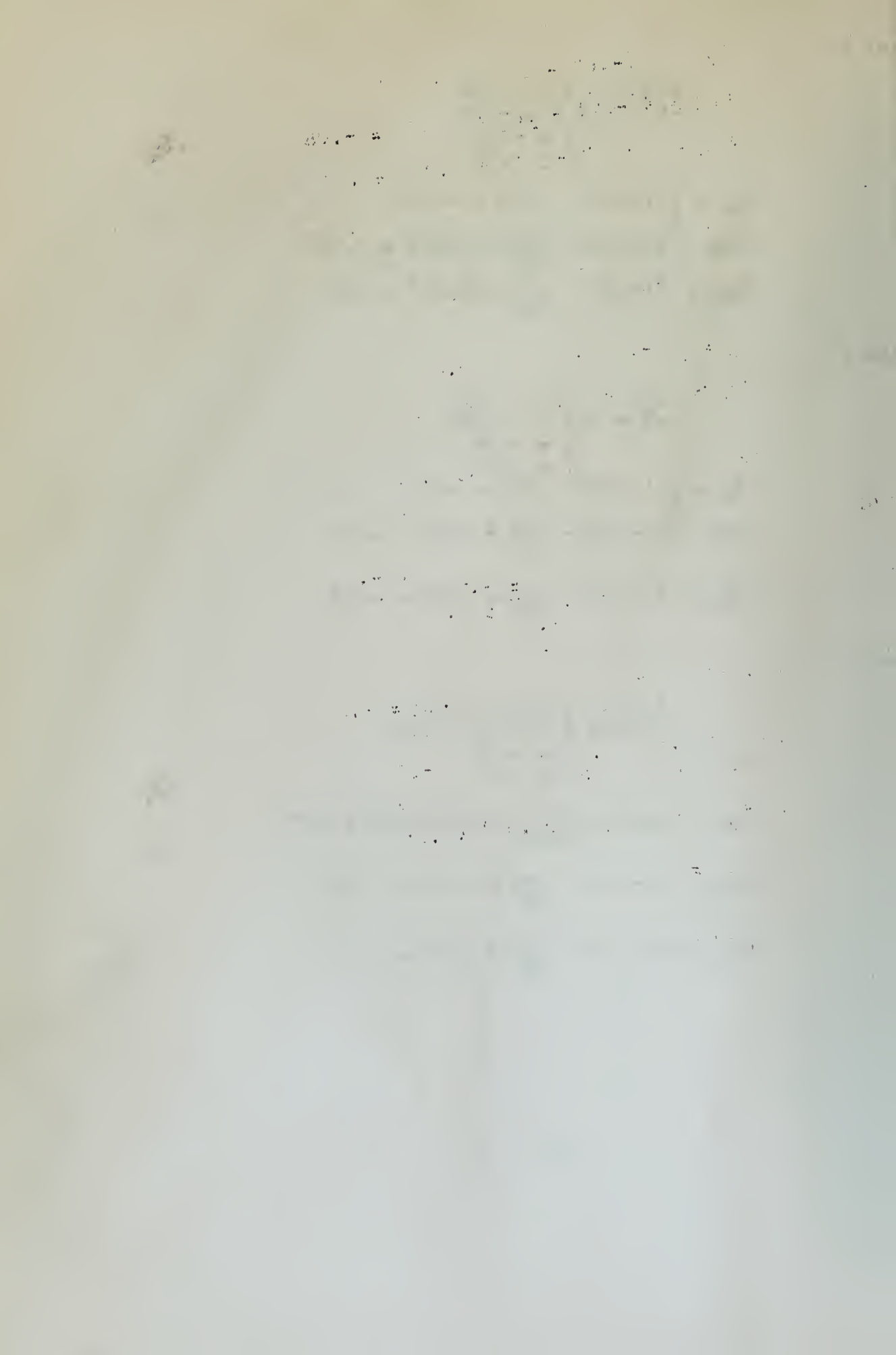
Panel 6

$$\begin{aligned} 4.06 - 0.89 F &= -.81 \\ -1.026 + 2.53 F &= -.96 \\ F &= -.50 \\ G &= -.31 \end{aligned}$$

$$R_6 = \frac{-2.95 \times .31 - 2.90 \times .50}{3.90} = -.61$$

$$M_{FG} = 3(-.50 - \frac{.31}{2} + .61) = -.15$$

$$M_{GF} = 3(-.31 - \frac{.50}{2} + .61) = .15$$



Panel 7

$$\begin{aligned}5.34 H - 0.63 G &= -.93 \\-0.77 H + 3.77 G &= -.98 \\G &= -.30 \\H &= -.21\end{aligned}$$

$$R_7 = \frac{-2.96 \times .21 - 2.91 \times .3}{3.91} = -.38$$

$$M_{GH} = 2(-.30 - \frac{.21}{2} + .38) = -.06$$

$$M_{HG} = 2(-.21 - \frac{.30}{2} + .38) = .06$$

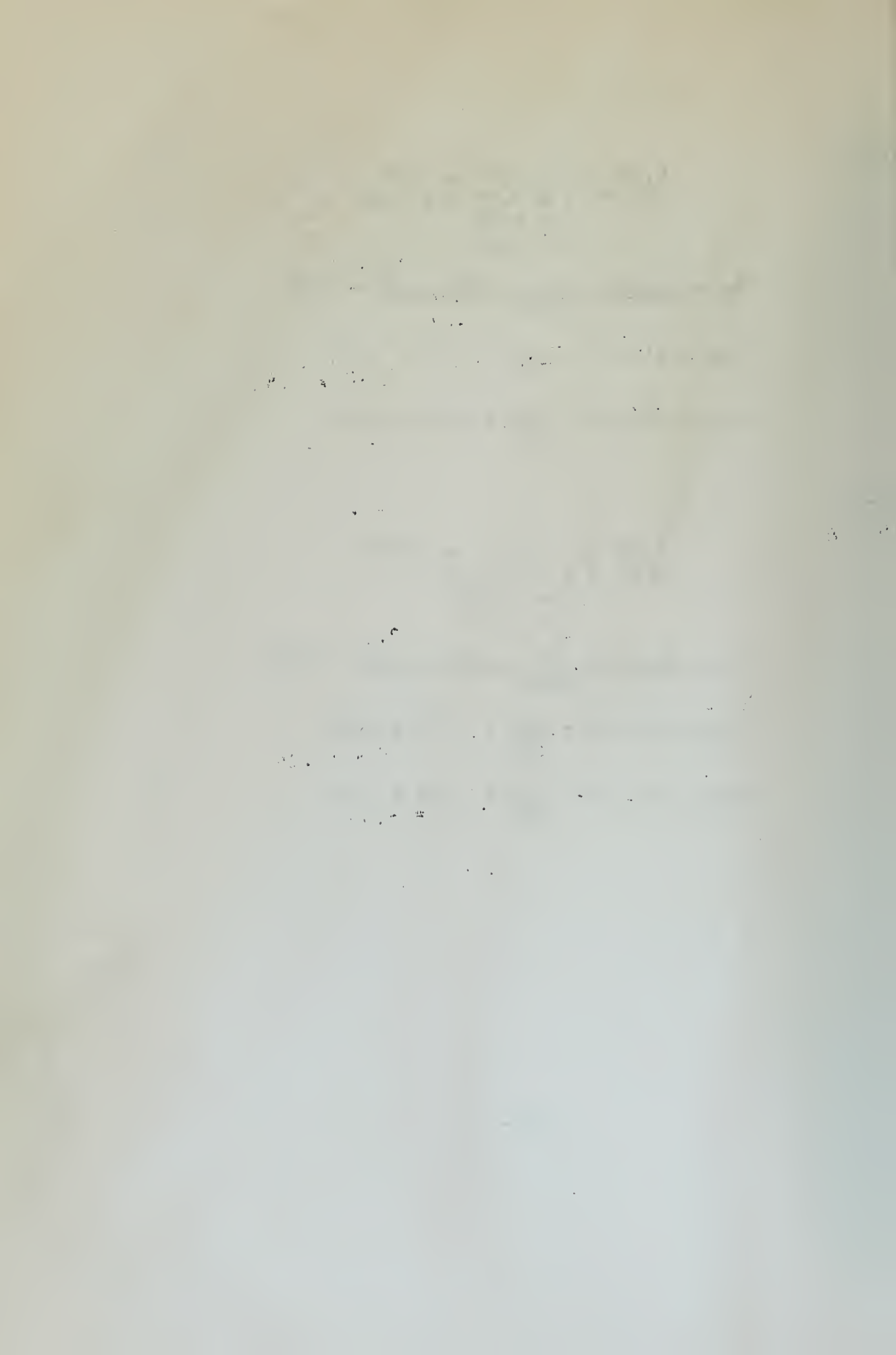
Panel 8

$$\begin{aligned}5.02 H - 0.52 I &= -.0.93 \\-0.20 H + 6.77 I &= 0 \\H &= -0.19 \\I &= -0.01\end{aligned}$$

$$R_8 = \frac{-2.91 \times .01 - 2.83 \times .19}{3.83} = -0.15$$

$$M_{HI} = 2(-.19 - \frac{.01}{2} + .15) = -.08$$

$$M_{IH} = 2(-.01 - \frac{.19}{2} + .15) = .08$$



SECOND MOMENT CORRECTIONS

Load at B

Panel 1

$$\begin{aligned} 6.77 A - 0.20 B &= 0 \\ -0.52 A + 5.02 B &= -.60 \end{aligned}$$

$$\begin{aligned} A &= 0 \\ B &= -.12 \end{aligned}$$

$$R_1 = \frac{-2.83 \times .12}{3.83} = -.09$$

$$M_{AB} = 2\left(0 - \frac{.12}{2} + .09\right) = .06$$

$$M_{BA} = 2(-.12 + .09) = -.06$$

Panel 2

$$5.34 B - 0.63 C = -.12$$

$$-0.77 B + 3.77 C = .12$$

$$B = .03$$

$$C = .04$$

$$R_2 = \frac{-2.96 \times .03 - 2.91 \times .04}{3.91} = -.05$$

$$M_{BC} = 2(-.03 - \frac{.04}{2} + .05) = 0$$

$$M_{CB} = 2(-.04 - \frac{.03}{2} + .05) = -.01$$

Load at PP1

	Panel	1		2		3		4	
	Joint	A	B	B	C	C	D	D	E
Initial Values	-Q	+5.32	+6.27	-1.16	-1.21	-1.16	-1.19	-0.94	-0.94
	∞	+1.31	+1.33	-0.26	-0.37	-0.43	-0.64	-0.63	-0.63
	R	+4.76		-0.87		-1.10		-1.18	
	M'	-6.56	-6.04	+1.29	+1.11	+1.40	+1.10	+0.96	+0.96
First Incre- ment	-Q	+0.00	-1.29	+6.04	-1.40	-1.11	-0.96	-1.10	-0.96
	∞	-0.01	-0.25	+1.11	-0.14	-0.39	-0.54	-0.71	-0.67
	R	-0.19		+0.74		-0.70		-1.03	
	M'	+0.12	-0.12	+0.60	-0.64	+ .12	- .12	- .08	+ .04
	-Q	+0.00	-0.60	-0.12	-0.12	+0.64	-0.04	+0.12	+0.12
	∞	+0.00	-0.12	-0.03	-0.04				
	R	-0.09		-0.05					
	M'	+0.06	-0.06	+0.00	-0.01	-	-	-	-
	M	-6.38	-6.22	+1.89	+0.46	+1.52	+0.98	+0.88	+1.00

	5		6		7		8	
	E	F	F	G	G	H	H	I
-Q	-0.94	-0.94	-0.82	-0.80	-0.87	-0.83	-0.90	-0.73
α	-0.63	-0.63	-0.47	-0.30	-0.27	-0.19	-0.21	-0.11
R	-1.18		-0.78		-0.63		-0.73	
M	+0.96	+0.96	+0.64	+0.98	+0.81	+0.93	+0.93	+1.02
-Q	-0.96	-0.64	-0.96	-0.81	-0.98	-0.93	-0.93	+0.00
α	-0.49	-0.58	-0.50	-0.31	-0.30	-0.21	-0.19	-0.01
R	-0.80		-0.61		-0.38		-0.15	
M'	+0.08	-0.12	-0.15	+0.15	-0.06	+0.06	-0.08	+0.08
	+0.08	+0.15	+0.12	+0.06	-0.15	+0.08	-0.06	
	-	-	-	-	-	-	-	-
	+1.04	+0.84	+0.49	+1.13	+0.75	+0.99	+0.85	+1.10

First Moment Corrections

Load at C

Panel 1

$$6.77A - 0.20B = 0$$

$$-0.52A + 5.02B = 5.55$$

$$A = .33$$

$$B = 1.11$$

$$R_1 = \frac{2.91 \times .33 + 2.83 \times 1.11}{3.33} = 1.07$$

$$M_{AB} = 2\left(.33 + \frac{1.11}{2} - 1.07\right) = -.36$$

$$M_{BA} = 2\left(1.11 + \frac{.33}{2} - 1.07\right) = .40$$

Panel 2

$$5.34B - 0.63C = 5.16$$

$$-0.77B + 3.77C = -2.40$$

$$B = .91$$

$$C = -.45$$

$$R_2 = \frac{2.96 \times .91 - 2.91 \times .45}{3.91} = .35$$

$$M_{BC} = 2\left(.91 - \frac{.45}{2} - .35\right) = 1.02$$

$$M_{CB} = 2\left(-.45 + \frac{.91}{2} - .35\right) = -1.05$$

Panel 3

$$4.06C - 0.89D = 4.83$$

$$-1.02C + 2.53D = -1.88$$

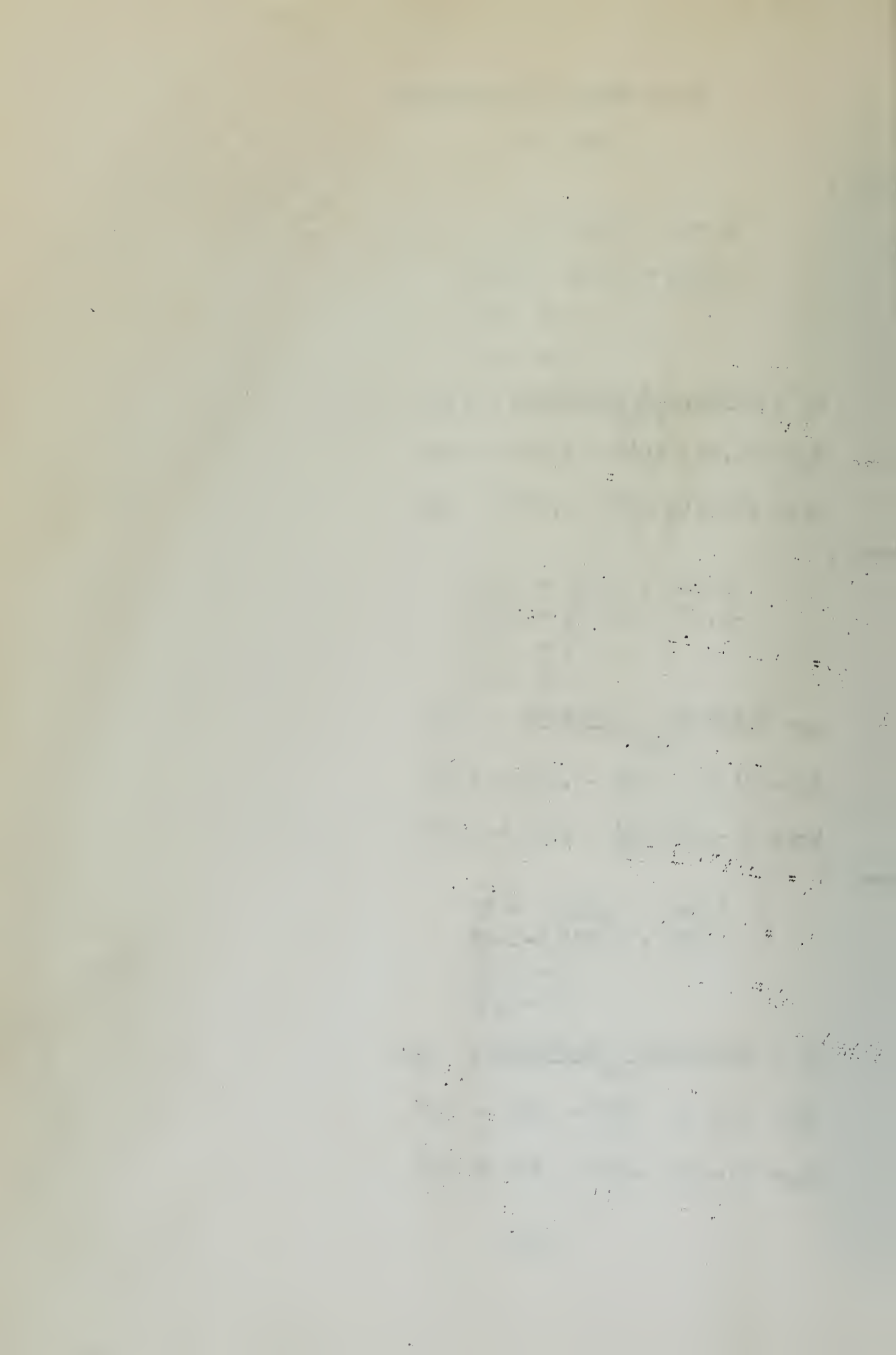
$$C = 1.13$$

$$D = -0.29$$

$$R_3 = \frac{2.95 \times 1.13 - 2.90 \times .29}{3.90} = .64$$

$$M_{CD} = 3\left(1.13 - \frac{.29}{2} - .64\right) = 1.08$$

$$M_{DC} = 3\left(-.29 + \frac{1.13}{2} - .64\right) = -1.08$$



Panel 4

$$\begin{aligned} 2.5D - E &= -2.32 \\ -D + 2.5E &= -1.88 \\ D &= -1.34 \\ E &= -1.46 \end{aligned}$$

$$R_4 = \frac{3}{4}(-1.34 - 1.46) = -2.10$$

$$M_{DE} = 4(-1.34 - \frac{1.46}{2} + 2.10) = .12$$

$$M_{ED} = 4(-1.46 - \frac{1.34}{2} + 2.10) = -.12$$

Panel 5

$$\begin{aligned} 2.5E - F &= -1.88 \\ -E + 2.5F &= -1.29 \\ E &= -1.14 \\ F &= -.97 \end{aligned}$$

$$R_5 = \frac{3}{4}(-1.14 - .97) = -1.58$$

$$M_{EF} = 4(-1.14 - \frac{.97}{2} + 1.58) = -.16$$

$$M_{FE} = 4(-.97 - \frac{1.14}{2} + 1.58) = .16$$

Panel 6

$$\begin{aligned} 2.53F - 1.02G &= -1.88 \\ -0.89F + 4.06G &= -1.62 \\ F &= -.99 \\ G &= -.62 \end{aligned}$$

$$R_6 = \frac{-2.95 \times .62 - 2.90 \times .60}{3.91} = -.77$$

$$M_{FG} = 3(-.99 - \frac{.62}{2} + .77) = -.40$$

$$M_{GF} = 3(-.62 - \frac{.99}{2} + .77) = .32$$

Panel 7

$$3.77G - 0.77H = -1.96$$

$$-0.63G + 5.34H = -1.85$$

$$G = -.60$$

$$H = -.42$$

$$R_7 = \frac{-2.91 \times .60 - 2.96 \times .42}{3.91} = -.77$$

$$M_{GH} = 2(-.60 - \frac{.42}{2} + .77) = -.12$$

$$M_{HG} = 2(-.42 - \frac{.60}{2} + .77) = .15$$

Panel 8

$$5.02H - 0.52I = -1.87$$

$$-0.20H + 6.72I = 0$$

$$H = -.37$$

$$I = -.01$$

$$R_8 = \frac{-2.83 \times .37 - 2.91 \times .01}{3.83} = -.28$$

$$M_{HI} = 2(-.37 - \frac{.01}{2} + .28) = -.18$$

$$M_{IH} = 2(-.01 - \frac{.37}{2} + .28) = .18$$

Second Moment Corrections - Load at C

Panel 1

$$\begin{aligned} 6.77A - 0.20B &= 0 \\ -0.52A + 5.02B &= -1.02 \\ A &= -.01 \\ B &= -.20 \end{aligned}$$

$$R_1 = \frac{-2.91 \times .01 - 2.83 \times .20}{3.83} = -.16$$

$$M_{AB} = 2(-.01 - \frac{.20}{2} + .16) = .10$$

$$M_{BA} = 2(-.20 - \frac{.01}{2} + .16) = -.10$$

Panel 2

$$\begin{aligned} 5.34B - 0.63C &= -.40 \\ -0.77B + 3.77C &= -1.08 \\ B &= -.11 \\ C &= -.28 \end{aligned}$$

$$R_2 = \frac{-2.96 \times .11 - 2.91 \times .28}{3.91} = -.30$$

$$M_{BC} = 2(-.11 - \frac{.28}{2} + .30) = .15$$

$$M_{CB} = 2(-.28 - \frac{.11}{2} + .30) = -.09$$

Panel 3

$$\begin{aligned} 4.06C - 0.89D &= 1.05 \\ -1.02C + 2.53D &= -.12 \\ C &= .27 \\ D &= .06 \end{aligned}$$

$$R_3 = \frac{2.95 \times .27 + 2.90 \times .06}{3.90} = .24$$

$$M_{CD} = 3(.27 + \frac{.06}{2} - .24) = .24$$

$$M_{DC} = 3(.06 + \frac{.27}{2} - .24) = -.16$$

Panel 4

$$2.5D - E = 1.08$$

$$-D + 2.5E = .16$$

$$D = .74$$

$$E = .36$$

$$R_5 = \frac{3}{4}(.74 + .36) = .82$$

$$M_{DE} = 4(.74 + \frac{.36}{2} - .82) = .40$$

$$M_{ED} = 4(.36 + \frac{.74}{2} - .82) = -.36$$

Panel 5

$$2.5E - F = .12$$

$$-E + 2.5F = .40$$

$$E = .13$$

$$F = .21$$

$$R_5 = \frac{3}{4}(.13 + .21) = .25$$

$$M_{EF} = 4(.13 + \frac{.21}{2} - .25) = -.08$$

$$M_{FE} = 4(.21 + \frac{.13}{2} - .25) = .08$$

Panel 6

$$2.53F - 1.02G = -.16$$

$$-0.89F + 4.06G = .12$$

$$F = -.06$$

$$G = .02$$

$$R_6 = \frac{-2.90 \times .06 + 2.95 \times .02}{3.90} = -.03$$

$$M_{FG} = 3(-.06 + \frac{.02}{2} + .03) = -.06$$

$$M_{GF} = 3(.02 - \frac{.06}{2} + .03) = .06$$

Panel 7

$$3.77G - 0.77H = -.32$$

$$-0.63G + 5.34H = .18$$

$$G = -.08$$

$$H = .02$$

$$R_7 = \frac{2.96 \times .02 - 2.91 \times .08}{3.91} = -.04$$

$$M_{GH} = 2(-.08 + \frac{.02}{2} + .04) = -.06$$

$$M_{HG} = 2(.02 - \frac{.08}{2} + .04) = .04$$

Panel 8

$$5.02H - 0.52I = -.15$$

$$-0.20H + 6.77I = 0$$

$$H = -.03$$

$$I = 0$$

$$R_8 = \frac{-2.83 \times .03}{3.83} = -.02$$

$$M_{HI} = 2(-.03 + .02) = -.02$$

$$M_{IH} = 2(\frac{-.03}{2} + .02) = .02$$

Load at PP2

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	4.56	5.38	4.98	5.23	-2.33	-2.38	-1.87	-1.87
×	0.71	1.14	1.14	1.62	-0.72	-0.76	-1.25	-1.25
R	4.07		3.80		-1.70		-2.34	
M'	-5.58	-5.16	-5.55	-4.83	2.40	2.32	1.88	1.88
-Q	0.00	5.55	5.16	-2.40	4.83	-1.88	-2.32	-1.88
×	0.33	1.11	0.91	-0.45	1.13	-0.29	-1.34	-1.46
R	1.07		0.35		0.64		-2.10	
M''	-0.36	0.40	1.02	-1.05	1.08	-1.08	0.12	-0.12
-Q	0.00	-1.02	-0.40	-1.08	1.05	-0.12	1.08	0.16
×	-0.01	-0.20	-0.11	-0.28	0.27	0.06	0.74	0.36
R	-0.16		-0.30		0.24		0.82	
M'''	0.10	-0.10	0.15	-0.09	0.24	-0.16	0.40	-0.36
M	-5.84	-4.81	-4.38	-5.97	3.72	1.08	2.40	1.40

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations

(1)
$$\frac{dx}{dt} = f(x, y, z), \quad \frac{dy}{dt} = g(x, y, z), \quad \frac{dz}{dt} = h(x, y, z)$$

where f, g, h are continuous functions of x, y, z and satisfy the Lipschitz condition.

2. In the second part we consider the case when the functions f, g, h are linear in x, y, z .

3. In the third part we consider the case when the functions f, g, h are quadratic in x, y, z .

4. In the fourth part we consider the case when the functions f, g, h are cubic in x, y, z .

5. In the fifth part we consider the case when the functions f, g, h are quartic in x, y, z .

6. In the sixth part we consider the case when the functions f, g, h are quintic in x, y, z .

7. In the seventh part we consider the case when the functions f, g, h are sextic in x, y, z .

8. In the eighth part we consider the case when the functions f, g, h are septic in x, y, z .

9. In the ninth part we consider the case when the functions f, g, h are octic in x, y, z .

10. In the tenth part we consider the case when the functions f, g, h are nonic in x, y, z .

11. In the eleventh part we consider the case when the functions f, g, h are decic in x, y, z .

12. In the twelfth part we consider the case when the functions f, g, h are undecimic in x, y, z .

13. In the thirteenth part we consider the case when the functions f, g, h are duodecimic in x, y, z .

14. In the fourteenth part we consider the case when the functions f, g, h are tredecimic in x, y, z .

15. In the fifteenth part we consider the case when the functions f, g, h are quattuordecimic in x, y, z .

16. In the sixteenth part we consider the case when the functions f, g, h are quindecimic in x, y, z .

17. In the seventeenth part we consider the case when the functions f, g, h are sexdecimic in x, y, z .

18. In the eighteenth part we consider the case when the functions f, g, h are septemdecimic in x, y, z .

19. In the nineteenth part we consider the case when the functions f, g, h are octodecimic in x, y, z .

20. In the twentieth part we consider the case when the functions f, g, h are novemdecimic in x, y, z .

5		6		7		8	
E	F	F	G	G	H	H	I
-1.87	-1.87	-1.64	-1.60	-1.75	-1.67	-1.79	-1.45
-1.25	-1.25	-0.94	-0.60	-0.54	-0.37	-0.41	-0.23
-2.34		-1.56		-1.27		-1.45	
1.88	1.88	1.29	1.96	1.62	1.87	1.85	2.04
-1.88	-1.29	-1.88	-1.62	-1.96	-1.85	-1.87	0.00
-1.14	-0.97	-0.99	-0.62	-0.60	-0.42	-0.37	-0.01
-1.58		-1.20		-0.77		-0.28	
-0.16	0.16	-0.40	0.32	-0.12	0.15	-0.18	0.18
0.12	0.40	-0.16	0.12	-0.32	0.18	-0.15	0.00
0.13	0.21	-0.06	0.02	-0.08	0.02	-0.03	0.00
0.25		-0.03		-0.04		-0.02	
-0.08	0.08	-0.06	0.06	-0.06	0.04	-0.02	0.02
1.64	2.12	0.83	2.34	1.38	2.06	1.65	2.24

Influence Lines - First Correction

Load at Panel Pt 3 (= D)

Panel 1

$$6.77A - .2B = 0$$

$$A = .03$$

$$-.52A + 5.02B = 4.71$$

$$R_1 = \frac{(3 - .0866).03 + (3 - .1732).94}{2(2 - .0866)} = .72$$

$$M_{AB} = 2(.03 + \frac{.94}{2} - .72) = -.44$$

$$M_{BA} = 2(.94 + \frac{.03}{2} - .72) = .46$$

Panel 2

$$5.34B - .62C = 4.30$$

$$B = .98$$

$$-.76B + 3.77C = 4.84$$

$$C = 1.48$$

$$R_2 = \frac{(3 - .0443).98 + (3 - .0886)1.48}{2(2 - .0443)} = 1.84$$

$$M_{BC} = 3(.98 + \frac{1.48}{2} - 1.84) = -.36$$

$$M_{CB} = 3(1.48 + \frac{.98}{2} - 1.84) = .39$$

Panel 3

$$4.05C - .9D = 4.11$$

$$C = .84$$

$$-1.02C + 2.53D = -2.84$$

$$D = -.78$$

$$R_3 = \frac{(3 - .0482).84 + (3 - .0964)(-.78)}{2(2 - .0482)} = .06$$

$$M_{CD} = 4(.84 - \frac{.78}{2} - .06) = 1.56$$

$$M_{DC} = 4(-.78 + \frac{.84}{2} - .06) = -1.68$$

Vol. 21, No. 19
Published by the American Medical Association, 535 North Dearborn Street, Chicago, Ill.
Subscription price, \$5.00 per annum in advance. Single copies, 15 cents.
Entered as Second-Class Matter, May 2, 1882. Postpaid at special rate of \$3.75 per annum.
Acceptance for mailing at special rate of postage provided for in Act of October 3, 1917.
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Panel 4

$$2.5D - 1E = 3.36$$

$$-1D + 2.5E = -2.81$$

$$D = 1.07$$

$$E = -.70$$

$$R = \frac{3}{4}(1.07 - .70) = .28$$

$$M_{DE} = 4(1.07 - \frac{.70}{2} - .28) = 1.76$$

$$M_{ED} = 4(-.70 + \frac{1.07}{2} - .28) = -1.80$$

Panel 5

$$2.5F - 1E = -2.84$$

$$-1F + 2.5E = -1.93$$

$$E = -1.46$$

$$F = -1.72$$

$$R = \frac{3}{4}(-1.46 - 1.72) = -2.38$$

$$M_{FE} = 4(-1.72 - \frac{1.46}{2} + 2.38) = -.28$$

$$M_{EF} = 4(-1.46 - \frac{1.72}{2} + 2.38) = .24$$

Panel 6

$$4.05G - 0.9F = -2.43$$

$$-1.02G + 2.53F = -2.81$$

$$G = -.93$$

$$F = -1.48$$

$$R = \frac{-(3 - .0482) \cdot .93 - (3 - .0964)1.48}{2(2 - .0482)} = -1.80$$

$$M_{FG} = 4(-1.48 - \frac{.93}{2} + 1.80) = -.56$$

$$M_{GF} = 4(-.93 - \frac{1.48}{2} + 1.80) = .52$$

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations (1) for arbitrary values of the parameters α and β . It is shown that the system has solutions for all values of the parameters α and β if the conditions (2) are satisfied.

2. In the second part of the paper the question of the stability of the solutions of the system (1) is considered. It is shown that the solutions of the system are stable with respect to the initial conditions if the conditions (3) are satisfied.

3. In the third part of the paper the question of the asymptotic behavior of the solutions of the system (1) is considered. It is shown that the solutions of the system tend to zero as $t \rightarrow \infty$ if the conditions (4) are satisfied.

4. In the fourth part of the paper the question of the existence of periodic solutions of the system (1) is considered. It is shown that the system has periodic solutions if the conditions (5) are satisfied.

Panel 7

$$5.34 \text{ H} - .62 \text{ G} = -2.78$$

$$-.76 \text{ H} + 3.77 \text{ G} = -2.94$$

$$\text{G} = -.91$$

$$\text{H} = -.63$$

$$\text{R} = - \frac{(3-.0443) \cdot .63 - (3-.0886) \cdot .91}{2(2-.0443)} = -1.15$$

$$\text{M}_{\text{GH}} = 3 \left(-.91 - \frac{.63}{2} + 1.15 \right) = -.21$$

$$\text{M}_{\text{HG}} = 3 \left(-.63 - \frac{.91}{2} + 1.15 \right) = .21$$

Panel 8

$$6.77 \text{ I} - .2 \text{ H} = 0$$

$$-.52 \text{ I} + 5.02 \text{ H} = -2.80$$

$$\text{H} = -.56$$

$$\text{I} = -.02$$

$$\text{R} = - \frac{(3-.0866) \cdot .02 - (3-.1732) \cdot .56}{2(2-.0866)} = -.43$$

$$\text{M}_{\text{HI}} = 2 \left(-.56 - \frac{.02}{2} + .43 \right) = -.28$$

$$\text{M}_{\text{IH}} = 2 \left(-.02 - \frac{.56}{2} + .43 \right) = .26$$

Influence Lines - Second Correction

Load @ PP3 = D

Panel 1

$$6.77 A - .2 B = 0$$

$$-.52 A + 5.02 B = +.44$$

$$A = .003$$

$$B = .090$$

$$R_1 = \frac{(3 - .0866) \cdot 0.003 + (3 - 1.732) \cdot 0.09}{2(2 - .0866)} = .094$$

$$M_{AB} = 2(.003 + \frac{.090}{2} - .094) = -.09$$

$$M_{BA} = 2(.090 + .003 - .094) = -.01$$

Panel 2

$$5.34 B - .62 C = -.46$$

$$-.76 B + 3.77 C = 1.56$$

$$B = -.04$$

$$C = .41$$

$$R_2 = \frac{(3 - .0443) \cdot -.04 + (3 - .0886)(+.41)}{2(2 - .0443)} = .28$$

$$M_{BC} = 3(-.04 + \frac{.41}{2} - .28) = -.36$$

$$M_{CB} = 3(+.41 - \frac{.04}{2} - .28) = .33$$

Panel 3

$$4.05 C - 0.9 D = -.39$$

$$-1.02 C + 2.53 D = -1.76$$

$$C = -.27$$

$$D = -.81$$

$$R_3 = \frac{(3 - .0482)(-.27) + (3 - .0964)(-.81)}{2(2 - .0482)} = -.80$$

$$M_{CD} = 4(-.27 - \frac{.81}{2} + .80) = .52$$

$$M_{DC} = 4(-.81 - \frac{.27}{2} + .80) = -.44$$

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Panel 4

$$2.5 D - 1E = 1.68$$

$$-1.0 D + 2.5 E = -.24$$

$$D = .75$$

$$E = .21$$

$$R_4 = \frac{3}{4} (.75 + .21) = .72$$

$$M_{DE} = 4(.75 + \frac{.21}{2} - .72) = .52$$

$$M_{ED} = 4(.21 + \frac{.75}{2} - .72) = -.56$$

Panel 5

$$-1 F + 2.5 E = 1.80$$

$$2.5 F + 1.0 E = 1.56$$

$$E = .96$$

$$F = .61$$

$$R_5 = \frac{3}{4} (.96 + .61) = 1.18$$

$$M_{EF} = 4(.96 + \frac{.61}{2} - 1.18) = .32$$

$$M_{FE} = 4(.61 + \frac{.96}{2} - 1.18) = -.40$$

Panel 6

$$-1.02 G + 2.53 F = .28$$

$$4.05 G - 0.9 F = .21$$

$$G = .08$$

$$F = .14$$

$$R_6 = \frac{(3-.0482).08 + (3-.0964).14}{2(2-.0482)} = .16$$

$$M_{FG} = 4(.14 + \frac{.08}{2} - .16) = .08$$

$$M_{GF} = 4(.08 + \frac{.14}{2} - .16) = -.04$$

Panel 7

$$-.76 H + 3.77 G = -.52$$

$$5.34 H - .62 G = .28$$

$$H = .04$$

$$G = -.13$$

$$R_7 = \frac{(3-.0443).04 - (3-.0886).13}{2(2-.0443)} = -.07$$

$$M_{GH} = 3(-.13 + \frac{.04}{2} + .07) = -.12$$

$$M_{HG} = 3(.04 - \frac{.13}{2} + .07) = .15$$

Panel 8

$$-.52 I + 5.02 H = -.21$$

$$6.77 I - 0.20 H = 0$$

$$I = 0$$

$$H = -.04$$

$$R_8 = -\frac{(3-.1732).04}{2(2-.0866)} = -.03$$

$$M_{HI} = 2(-.04 + .03) = -.02$$

$$M_{IH} = 2(-\frac{.04}{2} + .03) = .02$$

Load At PP3 = D

Panel Point	1		2		3		4	
	A	B	B	C	C	D	D	E
Q	3.81	4.49	4.16	4.36	4.02	4.12	-2.81	-2.81
Q	.59	.96	.94	1.34	1.49	2.23	-1.87	-1.87
R	3.40		3.18		3.81		-3.51	
M'	-4.66	-4.30	-4.71	-4.11	-4.84	-3.36	2.84	2.84
-Q	0	4.71	4.30	4.84	4.11	-2.82	3.36	-2.81
Q	.03	.94	.98	1.48	.84	-.78	1.07	-.70
R	.72		1.84		.06		.28	
M''	-.44	.46	-.36	.39	1.56	-1.68	1.76	-1.80
-Q	0	.44	-.46	1.56	-.39	-1.76	1.68	-.24
Q	.003	.090	-.04	.41	-.27	-.81	.75	.21
R	.094		.28		-.80		.72	
M'''	-.09	-.01	-.36	.33	.52	-.44	.52	-.56
Σ M	-5.19	-3.85	-5.43	-3.39	-2.76	-5.48	5.12	.48

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cont.)

[illegible]

Influence Lines - First Corrections
Load at E

Panels 1 & 8

$$6.77A - 0.20B = 0 \quad A = .02$$

$$-0.52A + 5.02B = 3.72 \quad B = .72$$

$$R_1 = \frac{2.914 \times .02 + 2.828 \times .72}{3.828} = .55$$

$$M_{AB} = 2\left(.02 + \frac{.72}{2} - .55\right) = -.34$$

$$M_{BA} = 2\left(.72 + \frac{.02}{2} - .55\right) = .36$$

Panels 2 & 7

$$5.34B - 0.63C = 3.60 \quad B = .81$$

$$-0.77B + 3.77C = 3.84 \quad C = 1.18$$

$$R_2 = \frac{2.96 \times .81 + 2.91 \times 1.18}{3.912} = 1.49$$

$$M_{BC} = 3\left(.81 + \frac{1.18}{2} - 1.49\right) = -.27$$

$$M_{CB} = 3\left(1.18 + \frac{.81}{2} - 1.49\right) = .27$$

Panels 3 & 6

$$4.06C - 0.89D = 3.24 \quad C = 1.23$$

$$-1.02C + 2.53D = 3.76 \quad D = 1.99$$

$$R_3 = \frac{2.95 \times 1.23 + 2.90 \times 1.99}{3.904} = 2.40$$

$$M_{CD} = 4\left(1.23 + \frac{1.99}{2} - 2.40\right) = -.72$$

$$M_{DC} = 4\left(1.99 + \frac{1.23}{2} - 2.40\right) = .80$$

Panels 4 & 5

$$2.5E - 1.0D = 2.68$$

$$-1.0E + 2.5D = -3.75$$

$$R_4 = \frac{3}{4}(-1.28 + .56) = -.54$$

$$M_{DE} = 4\left(-1.28 + \frac{.56}{2} + .54\right) = -1.84$$

$$M_{ED} = 4\left(.56 - \frac{1.28}{2} + .54\right) = 1.84$$

THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION
PUBLISHED WEEKLY
CHICAGO, ILL., U.S.A.
Subscription price, \$5.00 per annum in advance.
Single copies, 15 cents.
Entered as Second-Class Matter, May 2, 1917.
Postpaid.
Acceptance for mailing at special rate of postage provided for in Act of October 3, 1917.
Copyright, 1918, by American Medical Association
Published by the American Medical Association, 535 North Dearborn Street, Chicago, Ill.
Second-Class Postage Paid at Chicago, Ill.
Postmaster: Send address changes to JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 535 North Dearborn Street, Chicago, Ill.

Influence Lines - Second Correction

Load at E

Panels 1 & 8

$$6.77A - 0.20B = 0$$

$$A = 0$$

$$-0.52A + 5.02B = .27$$

$$B = .05$$

$$R_4 = .04$$

$$R_1 = \frac{2.914 \times 0 + 2.828 \times .05}{3.828}$$

$$M_{AB} = 2 \left(0 + \frac{.05}{2} - .04 \right) = -.04$$

$$M_{BA} = 2 \left(.05 + \frac{0}{2} - .04 \right) = .02$$

Panels 2 & 7

$$5.34B - 0.63C = -.36$$

$$B = -.05$$

$$-0.77B + 3.77C = .72$$

$$C = .18$$

$$R_2 = \frac{-2.96 \times .05 + 2.91 \times .18}{3.912}$$

$$R_4 = .10$$

$$M_{BC} = 3 \left(-.05 + \frac{.18}{2} - .10 \right) = -.18$$

$$M_{CB} = 3 \left(.18 - \frac{.05}{2} - .10 \right) = .18$$

Panels 3 & 6

$$4.06C - 0.89D = -.27$$

$$C = -.24$$

$$-1.02C + 2.53D = 1.84$$

$$D = -.86$$

$$R_3 = \frac{2.95(-.25) + 2.90(-.82)}{3.904}$$

$$R_3 = -.80$$

$$M_{CD} = 4 \left(-.25 - \frac{.82}{2} + .80 \right) = .56$$

$$M_{DC} = 4 \left(-.82 - \frac{.25}{2} + .80 \right) = -.56$$

Panels 4 & 5

$$2.5E - 1.0D = -.80$$

$$D = -.02$$

$$-1.0E + 2.5D = 1.84$$

$$E = .73$$

$$R_4 = \frac{3}{4}(-.02 + .73)$$

$$R_4 = .53$$

$$M_{DE} = 4 \left(-.02 + \frac{.73}{2} + .53 \right) = -.76$$

$$M_{ED} = 4 \left(.73 - \frac{.02}{2} - .53 \right) = .76$$

1. 5. 1.
2. 5. 2.
3. 5. 3.

1. 5. 1. - 1. 5. 1.
2. 5. 2. - 1. 5. 2.

1. 5. 1.
2. 5. 2.
3. 5. 3.

1. 5. 1.
2. 5. 2.
3. 5. 3.

1. 5. 1. - 1. 5. 1.
2. 5. 2. - 1. 5. 2.

Load at Panel Pt 4 = E

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	3.04	3.59	3.32	3.49	3.21	3.30	3.75	3.75
α	.47	.76	.75	1.08	1.19	1.78	2.50	2.50
R	2.79		2.53		3.04		4.69	
M'	-3.88	-3.60	-3.72	-3.24	-3.84	-2.68	-3.76	-3.76
-Q	0	3.72	3.60	3.84	3.24	3.76	2.68	-3.75
α	.02	.72	.81	1.18	1.23	1.99	-1.28	.56
R	.55		1.49		2.40		- .54	
M''	- .34	.36	- .27	.27	- .72	.80	1.84	-1.84
-Q	0	.27	- .36	.72	- .27	-1.84	- .80	1.84
α	0	.05	- .05	.18	- .25	- .82	- .02	.73
R	.04		.10		- .80		.53	
M'	- .04	.02	- .18	.18	.56	- .56	- .76	.76
M'''	-4.26	-3.32	-4.17	-2.79	-4.00	-2.44	-2.68	-4.84

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931	932	933	934	935	936
937	938	939	940	941	942
943	944	945	946	947	948
949	950	951	952	953	954
955	956	957	958	959	960
961	962	963	964	965	966
967	968	969	970	971	972
973	974	975	976	977	978
979	980	981	982	983	984
985	986	987	988	989	990
991	992	993	994	995	996
997	998	999	1000	1001	1002

Panel	5		6		7		8	
Joint	E	F	F	G	G	H	H	I
-Q	-3.75	-3.75	-3.29	-3.20	-3.50	-3.33	-3.58	-2.91
α	-2.50	-2.50	-1.87	-1.20	-1.08	-0.75	-0.83	-0.45
R	-4.69		-3.12		-2.53		-2.91	
M	3.75	3.75	2.58	3.92	3.24	3.73	3.60	4.08
-Q	3.76	-2.58	-3.75	-3.24	-3.92	-3.60	-3.72	0
α	1.30	- .51	-1.98	-1.23	-1.20	- .81	- .72	- .02
R	.59		-2.40		-1.51		- .55	
M'	1.84	1.80	- .76	.72	- .27	.30	- .36	.34
-Q	-1.84	.76	1.80	.27	- .72	.36	- .30	0
α	- .73	.02	.82	.25	- .18	.05	- .05	0
R	- .53		.80		- .10		- .04	
M''	- .76	.76	.56	- .56	- .18	.18	- .02	.04
M'''	4.83	2.71	2.38	4.08	2.79	4.18	3.22	4.26

Preliminary Moment Computations - Web Members

Member AA'

Moment Dh	=	3144	fk
hh E-60	=	2865	
Impact	=	<u>615</u>	
Total		3480	
hh H-15-S-12 44	=	368	
Conc	=	86	
Impact	=	<u>50</u>	
Total		504	
Sidewalk hh	=	220	
Design Moment	=	7362	fk

Member BB'

Dh	=	5170	
hh E-60	=	4410	
Impact	=	<u>950</u>	
Total		5360	
hh H15-S-12 44	=	605	
Conc.	=	125	
Impact	=	<u>83</u>	
Total		813	
Sidewalk hh	=	362	
Design Moment	=	11,745	fk

Member CC'

Dh	=	3000	
hh E-60	=	2630	
Impact	=	<u>830</u>	
Total		3460	
hh H15-S-12-44	=	350	
Conc.	=	92	
Impact	=	<u>67</u>	
Total		509	
Sidewalk hh	=	256	
Design Moment	=	7243	fk

Member DD'

DL = 1600

LL E-60 = 1480

Impact = 520

Total 2000

LL H15-S12-44 = 182

Conc. = 69

Impact = 37

Total 288

Sidewalk = 144

Design Moment = 4046 fk

Member EE'

DL = 945

LL E-60 = 910

Impact = 441

Total 1351

LL H15-S12-44 = 110

Conc. = 52

Impact = 26

Total 188

Sidewalk = 97

Design Moment = 2593 fk

Preliminary Moment Computations - Chord Members

Member AB

$$DL = 3440$$

$$LL \text{ E-60} = 3020$$

$$\text{Impact} = \underline{695}$$

$$\text{Total} = 3715$$

$$LL \text{ H15-S12-44} = 403$$

$$\text{Conc.} = 87$$

$$\text{Impact} = \underline{73}$$

$$\text{Total} = 563$$

$$\text{Sidewalk hh} = 240$$

$$\text{Design Moment} = 7958 \text{ fk}$$

Member BC

$$DL = 2260$$

$$LL \text{ E-60} = 2040$$

$$\text{Impact} = \underline{520}$$

$$\text{Total} = 2560$$

$$LL \text{ H15-S12-44} = 264$$

$$\text{Conc.} = 50$$

$$\text{Impact} = \underline{52}$$

$$\text{Total} = 366$$

$$\text{Sidewalk hh} = 173$$

$$\text{Design Moment} = 5360 \text{ fk}$$

Member CD

DL = 1432

LL E-60 = 1330

Impact = 383

Total 1713

LL H15-S12-44 = 168

Conc. = 73

Impact = 44

Total 285

Sidewalk = 118

Design Moment = 3548 fk

Member DE

DL = 1480

LL E-60 = 1400

Impact = 490

Total 1890

LL H15-S12-44 = 173

Conc. = 66

Impact = 49

Total 288

Sidewalk = 133

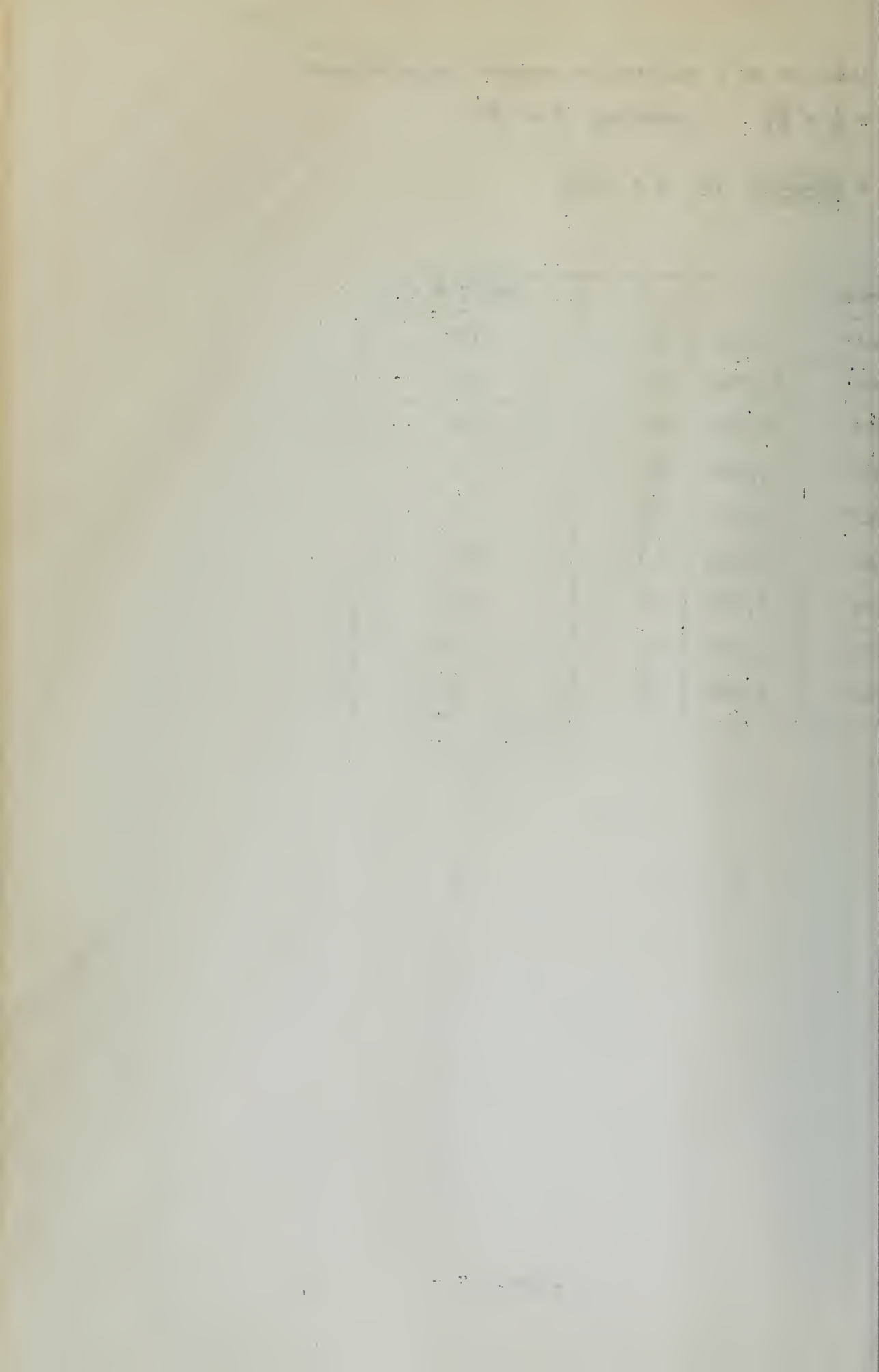
Design Moment = 3790 fk

Determination of K values for second computations

$K = \frac{I}{L} = \frac{Mc}{fL}$ Assuming $C = 15''$

$K = \frac{N \times 15 \times 12}{20 \times L \times 12}$ or $K = .75 \frac{M}{L}$

Member	M	L	.75M/L = K
AA'	7362	35	160
BB'	11,745	38	232
CC'	7,243	40	136
DD'	4,064	41	74
EE'	2,593	41	47
AB	7,958	30	200
BC	5,360	30	134
CD	3,548	30	90
DE	3,790	30	95



Influence Line Computations - Second Set
Load at B

Panel 1

$$\begin{aligned} -Q_A &= \frac{(.0942 \times 160 - 200)(.0866 \times 26.25 - .875 \times 30)}{2(2 - .0866)200} = 0.11 \\ -Q_B &= \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)} = 6.28 \\ Q_{R1} &= \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)200} = 0.31 \end{aligned}$$

Panel 2

$$\begin{aligned} -Q_B &= \frac{(.0463 \times 232 - 134)(.0443 \times 22.5 + .125 \times 30)}{2(2 - .0443)134} = -1.11 \\ -Q_C &= \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)} = -1.21 \\ Q_{R2} &= \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)134} = -.009 \end{aligned}$$

Panel 3

$$\begin{aligned} -Q_C &= \frac{(.0507 \times 136 - 90)(.0482 \times 18.75 + .125 \times 30)}{2(2 - .0482)90} = -1.10 \\ -Q_D &= \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)} = -1.19 \\ Q_{R3} &= \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)90} = -0.13 \end{aligned}$$

Panel 4

$$\begin{aligned} -Q_D &= \frac{-95(.125 \times 30)}{4 \times 95} = -.94 \\ -Q_E &= \frac{(-.125 \times 30)}{4} = -.94 \\ Q_{R4} &= \frac{(-.125 \times 30)}{4 \times 95} = -.01 \end{aligned}$$

Panel 5

$$-Q_E = \frac{-1.25 \times 30}{4} = -.94$$

$$-Q_F = \frac{-1.25 \times 30}{4} = -.94$$

$$Q_{E5} = \frac{-1.25 \times 30}{4 \times 95} = -.0099$$

Panel 6

$$-Q_G = \frac{(.0507 \times 136 - 90)(-.0482 \times 11.25 + .125 \times 30)}{2(2 - .0482)90} = -.76$$

$$-Q_F = \frac{(-1.25 \times 30 + .0482 \times 11.25)}{2(2 - .0482)} = -.82$$

$$Q_{R6} = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)90} = -.0091$$

Panel 7

$$-Q_H = \frac{(.0463 \times 134 - 134)(-.0443 \times 7.5 + .125 \times 30)}{2(2 - .0443)134} = -.81$$

$$-Q_G = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)} = -.87$$

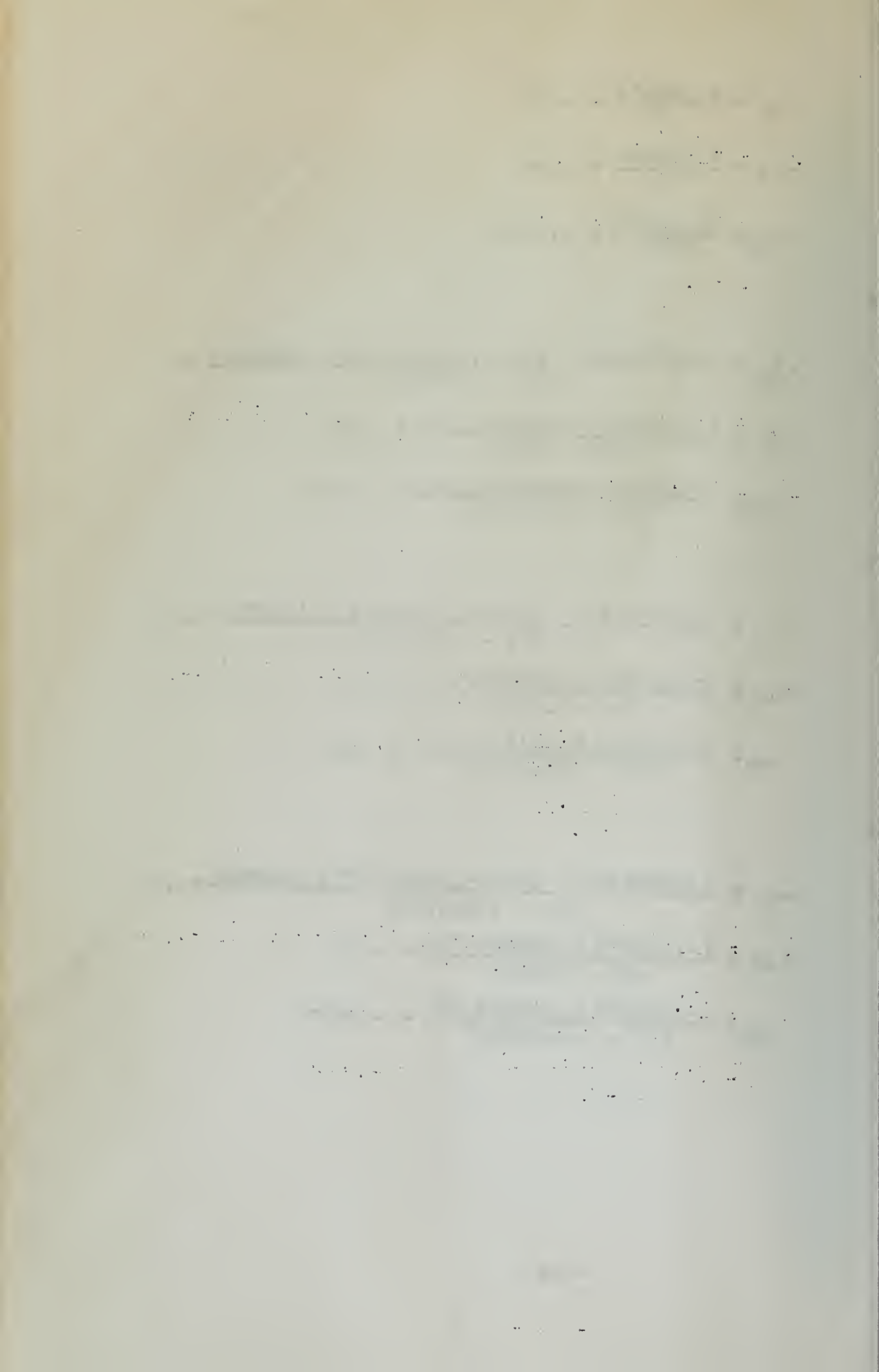
$$Q_{R7} = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)134} = -.065$$

Panel 8

$$-Q_I = \frac{(.0942 \times 160 - 200)(-.0866 \times 3.75 + .125 \times 30)}{2(2 - .0866)200} = -.83$$

$$-Q_H = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)} = -.90$$

$$Q_{R8} = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)200} = -.0045$$



Panel 1

$$-Q_A = \frac{(.0942 \times 160 - 200)(.0866 \times 22.5 - .75 \times 30)}{2(2 - .0866)200} = 4.98$$

$$-Q_B = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R1} = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)200} = 0.27$$

Panel 2

$$-Q_B = \frac{(.0463 \times 232 - 134)(.0443 \times 45 - .75 \times 30)}{2(2 - .0443)134} = 4.82$$

$$-Q_C = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)} = 5.24$$

$$Q_{R2} = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)134} = 0.39$$

Panel 3

$$-Q_C = \frac{(.0507 \times 136 - 90)(.0482 \times 37.5 + .25 \times 30)}{2(2 - .0482)90} = -2.20$$

$$-Q_D = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)} = -2.39$$

$$Q_{R3} = \frac{-.25 \times 30 - .0482 \times 37.5}{2(2 - .0482)90} = -.027$$

Panel 4

$$-Q_D = \frac{(-95)(.25 \times 30)}{4 \times 95} = -1.87$$

$$-Q_E = \frac{(-.25 \times 30)}{4} = -1.87$$

$$Q_{R4} = \frac{-.25 \times 30}{4 \times 95} = -.020$$

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations

$$\frac{dx}{dt} = P(x, y, z), \quad \frac{dy}{dt} = Q(x, y, z), \quad \frac{dz}{dt} = R(x, y, z),$$

where P, Q, R are continuous functions of x, y, z in a certain domain.

2. In the second part we consider the case when the functions P, Q, R are linear in x, y, z .

$$\frac{dx}{dt} = a_1x + b_1y + c_1z, \quad \frac{dy}{dt} = a_2x + b_2y + c_2z, \quad \frac{dz}{dt} = a_3x + b_3y + c_3z,$$

where a_i, b_i, c_i are constants.

3. In the third part we consider the case when the functions P, Q, R are quadratic in x, y, z .

4. In the fourth part we consider the case when the functions P, Q, R are cubic in x, y, z .

5. In the fifth part we consider the case when the functions P, Q, R are of higher order in x, y, z .

6. In the sixth part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

7. In the seventh part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

8. In the eighth part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

9. In the ninth part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

10. In the tenth part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

11. In the eleventh part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

Panel 5

$$-Q_E = -1.88$$

$$-Q_F = -1.88$$

$$Q_{R5} = -.020$$

Panel 6

$$-Q_F = -1.64$$

$$-Q_G = -1.52$$

$$Q_{R6} = -.018$$

Panel 7

$$-Q_G = -1.74$$

$$-Q_H = -1.62$$

$$Q_{R7} = -.013$$

Panel 8

$$-Q_H = -1.80$$

$$-Q_I = -1.66$$

$$Q_{R8} = -.0090$$

Load at D

Panel 1

$$-Q_A = \frac{(.0942 \times 160 - 200)(.0866 \times 18.75 - .625 \times 30)}{2(2 - .0866)200} = 4.15$$

$$-Q_B = \frac{.625 \times 30 - .0866 \times 18.75}{2(2 - .0866)} = 4.49$$

$$Q_{R1} = \frac{.625 \times 30 - .0866 \times 18.75}{2(2 - .0866)200} = .022$$

Panel 2

$$-Q_B = \frac{(.0463 \times 232 - 134)(.0443 \times 37.5 - .625 \times 30)}{2(2 - .0443)134} = 4.02$$

$$-Q_C = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)} = 4.36$$

$$Q_{R2} = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)134} = .033$$

Panel 3

$$-Q_C = \frac{(.0507 \times 136 - 90)(.0482 \times 56.25 - .625 \times 30)}{2(2 - .0482)90} = 3.80$$

$$-Q_D = \frac{(.625 \times 30 - .0482 \times 56.25)}{2(2 - .0482)} = 4.12$$

$$Q_{R3} = \frac{(.625 \times 30 - .0482 \times 56.25)}{2(2 - .0482)90} = .046$$

Panel 4

$$-Q_D = \frac{(-.95)(.375 \times 30)}{4 \times 95} = -2.81$$

$$-Q_E = \frac{(-.375 \times 30)}{4} = -2.81$$

$$Q_{R4} = \frac{(-.375 \times 30)}{4 \times .95} = .030$$

1870

1871

1872

1873

1874

1875

1876

1877

1878

1879

1880

1881

1882

Panel 5

$$-Q_E = -2.82$$

$$-Q_F = -2.82$$

$$Q_{R5} = -.030$$

Panel 6

$$-Q_F = -2.46$$

$$-Q_G = -2.28$$

$$Q_{R6} = -0.27$$

Panel 7

$$-Q_G = -2.61$$

$$-Q_H = -2.43$$

$$Q_{R7} = -.020$$

Panel 8

$$-Q_H = -2.70$$

$$-Q_I = -2.49$$

$$Q_{R8} = -.014$$

1870
1871
1872

1873
1874
1875

1876
1877
1878

1879
1880
1881

Load at E

Panel 1

$$-Q_A = \frac{(.0942 \times 160 - 200)(.0866 \times 15 - .5 \times 30)}{2(2 - .0866)200} = 3.32$$

$$-Q_B = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)} = 3.59$$

$$Q_{R1} = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)200} = .018$$

Panel 2

$$-Q_B = \frac{(.0463 \times 132 - 134)(.0443 \times 30 - .5 \times 30)}{2(2 - .0443)134} = 3.22$$

$$-Q_C = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)} = 3.49$$

$$Q_{R2} = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)134} = .026$$

Panel 3

$$-Q_C = \frac{(.0507 \times 136 - 90)(.0482 \times 45 - .5 \times 30)}{2(2 - .0482)90} = 3.04$$

$$-Q_D = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)} = 3.30$$

$$Q_{R3} = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)90} = .037$$

Panel 4

$$-Q_D = \frac{(-95)(-.5 \times 30)}{4 \times 95} = 3.75$$

$$-Q_E = \frac{(.5 \times 30)}{4} = 3.75$$

$$Q_{R4} = \frac{.5 \times 30}{4 \times 95} = .040$$

My dear Mr. Brewster,

I have just received your letter of the 17th inst.

and am glad to hear from you.

I have been very busy lately, but I have managed to find some time to write you.

I have been thinking of you very much lately, and I hope you are well.

I have been very busy lately, but I have managed to find some time to write you.

I have been thinking of you very much lately, and I hope you are well.

I have been very busy lately, but I have managed to find some time to write you.

I have been thinking of you very much lately, and I hope you are well.

I have been very busy lately, but I have managed to find some time to write you.

I have been thinking of you very much lately, and I hope you are well.

I have been very busy lately, but I have managed to find some time to write you.

Panel 5

$$-Q_E = -3.78$$

$$-Q_F = -3.78$$

$$Q_{R5} = -.040$$

Panel 6

$$-Q_E = -3.28$$

$$-Q_G = -3.04$$

$$Q_{R6} = -.036$$

Panel 7

$$-Q_G = -3.48$$

$$-Q_H = -3.24$$

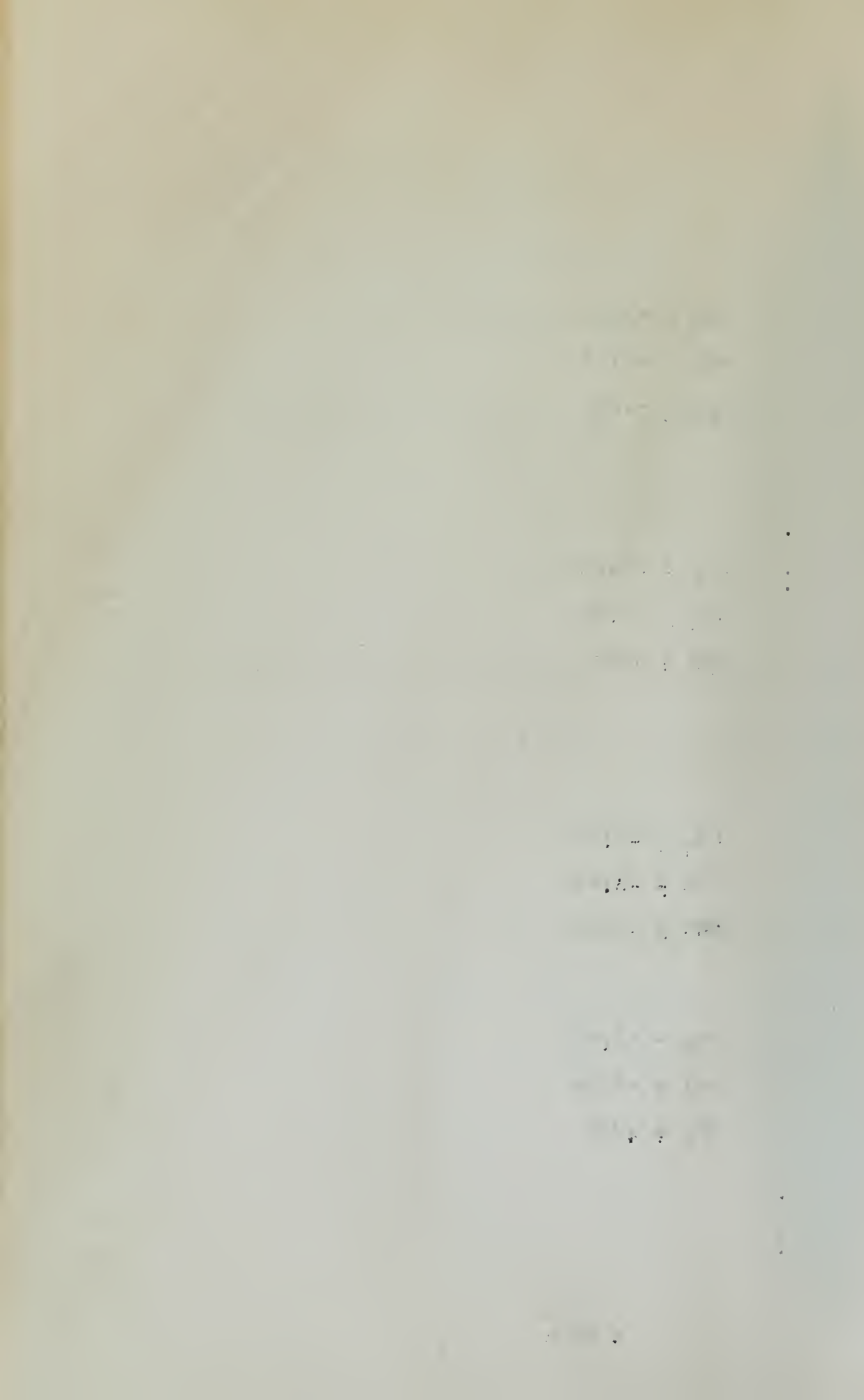
$$Q_{R7} = -.026$$

Panel 8

$$-Q_H = -3.60$$

$$-Q_I = -3.32$$

$$Q_{R8} = .018$$



Panel Constant Computations Load at B

Panel 1

$$\left[1.5 \times 160 + 200 + \frac{(3 - .0866)(.0942 \times 160 - 200)}{2(2 - .0866)} \right] A + \left[\frac{200}{2} + \frac{(3 - .1734)(.0942 \times 160 - 200)}{2(2 - .0866)} \right] B = 5.82$$

$$299A - 37B = 5.82$$

$$\left[200 + 1.5 \times 232 - \frac{(3 - .1732)200}{2(2 - .0866)} \right] B + \left[\frac{200}{2} - \frac{(3 - .0866)200}{2(2 - .0866)} \right] A = 6.28$$

$$400B - 52A = 6.28$$

Solving Simultaneously: $A = .022$ $B = .019$

$$R_1 = \frac{(3 - .0866)(.022) + (3 - .1732)(.019)}{2(2 - .0866)} + .031 = .062$$

Panel 2

$$\left[1.5 \times 232 + 134 + \frac{(3 - .0443)(.0463 \times 232 - 134)}{2(2 - .0443)} \right] B + \left[\frac{134}{2} + \frac{(3 - .0886)(.0463 \times 232 - 134)}{2(2 - .0443)} \right] C = -1.11$$

$$\left[134 + 1.5 \times 136 - \frac{(3 - .0886)134}{2(2 - .0443)} \right] C + \left[\frac{134}{2} - \frac{(3 - .0443)134}{2(2 - .0443)} \right] B = -1.21$$

$$238C - 34B = -1.21$$

Solving Simultaneously: $B = -.003$ $C = -.005$

$$R_2 = \frac{(3 - .0443)(-.003) + (3 - .0886)(-.005)}{2(2 - .0443)} - .009 = -.015$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

where

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

and

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Panel 3

$$.5x136 + 90 + \frac{(3-.0482)(.0507x136-90)}{2(2-.0482)} \Big] C \Big[\frac{90 + (3-.0964)(.0507x136-90)}{2} \frac{1}{2(2-.0482)} \Big]$$

$$D = -1.10$$

$$231C - 17D = 1.10$$

$$0 + 1.5x74 - \frac{(3-.0964)90}{2(2-.0482)} \Big] D + \frac{90 - (3-.0482)90}{2} \Big] C = -1.19$$

$$134D - 23C = -1.19$$

Solving Simultaneously: $C = -.0055; D = -.0098$

$$R_3 = \frac{(3-.0482)(-.0055) + (3-.0964)(-.0098)}{2(2-.0482)} - .013 = -.024$$

Panel 4

$$.5x74 + 95 + \frac{(3)(0-95)}{4} \Big] D + \frac{95 + (3)(0-95)}{2} \Big] E = -.94$$

$$135D - 24E = -.94$$

$$+ 1.5x47 - \frac{(3)95}{4} \Big] E + \frac{95 - (3)95}{2} \Big] D = -.94$$

$$94E - 24D = -.94$$

Solving Simultaneously $D = -.0092; E = -.012$

$$R_4 = \frac{3(-.0092) + 3(-.012)}{4} - .01 = -.026$$

1. The first part of the document is a list of names and addresses of the members of the committee.

2. The second part of the document is a list of the names and addresses of the members of the committee who have been elected to the office of the Secretary.

3. The third part of the document is a list of the names and addresses of the members of the committee who have been elected to the office of the Treasurer.

4. The fourth part of the document is a list of the names and addresses of the members of the committee who have been elected to the office of the Chairman.

5. The fifth part of the document is a list of the names and addresses of the members of the committee who have been elected to the office of the Vice-Chairman.

6. The sixth part of the document is a list of the names and addresses of the members of the committee who have been elected to the office of the Secretary.

7. The seventh part of the document is a list of the names and addresses of the members of the committee who have been elected to the office of the Treasurer.

8. The eighth part of the document is a list of the names and addresses of the members of the committee who have been elected to the office of the Chairman.

Panel 5

$$135E - 24F = -.94$$

$$-24E + 94F = -.94$$

$$E = -.012$$

$$F = -.0092$$

$$R_5 = \frac{3}{4} (-.0092 - .012) - .0099 = -.026$$

Panel 6

$$134F - 23G = -.82$$

$$-17F + 231G = -.76$$

$$F = -.0068$$

$$G = -.0039$$

$$R_6 = \frac{-2.95 \times .0039 - 2.90 \times .0068}{3.90} - .0091 = -.0173$$

Panel 7

$$238G - 34H = -.87$$

$$-25G + 389H = -.81$$

$$G = -.0040$$

$$H = -.0023$$

$$R_7 = \frac{-2.96 \times .0023 - 2.91 \times .0040}{3.91} - .0065 = -.0112$$

Panel 8

$$400H - 52I = -.90$$

$$-37H + 299I = -.83$$

$$H = -.0027$$

$$I = -.0031$$

$$R_8 = \frac{-2.91 \times .0031 - 2.83 \times .0027}{3.83} - .0045 = -.0088$$

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Panel Constant Computations - Load at C

Panel 1

$$299A - 37B = 4.98$$

$$-52A + 400B = 5.38$$

$$A = .019, B = .016$$

$$R_1 = \frac{2.91(.019) + 2.83(.016)}{2(1.91)} + .027 = .053$$

Panel 2

$$389B - 25C = 4.82$$

$$-34B + 238C = 5.24$$

$$B = .014, C = .024$$

$$R_2 = \frac{2.96(.014) + (2.91)(.024)}{3.92} + .039 = .067$$

Panel 3

$$231C - 17D = -2.20$$

$$-23C + 134D = -2.39$$

$$C = -.011, D = -.020$$

$$R_3 = \frac{2.95(-.011) + 2.90(-.020)}{3.90} + (-.027) = -.050$$

Panel 4

$$135D - 24E = -1.87$$

$$-24D + 94E = -1.87$$

$$D = -.018, E = -.025$$

$$R_4 = \frac{3(-.018) + 3(-.025)}{4} + (-.020) = -.052$$

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Panel 5

$$E = -.024$$

$$F = -.018$$

$$R_5 = -.052$$

Panel 6

$$F = -.014$$

$$G = -.0078$$

$$R_6 = -.034$$

Panel 7

$$G = -.0080$$

$$H = -.0046$$

$$R_7 = -.022$$

Panel 8

$$H = -.0054$$

$$I = -.0062$$

$$R_8 = -.018$$

Panel Constant Computations - Load at PP3

Panel 1

$$299A - 37B = 4.15$$

$$-52A + 400B = 4.49$$

Solving Simultaneously; $A = .016$, $B = .013$

$$R_1 = \frac{2.91(.016) + 2.83(.013)}{3.82} + .022 = .044$$

Panel 2

$$389B - 25C = 4.02$$

$$-34B + 238C = 4.36$$

Solving Simultaneously; $B = .012$, $C = .020$

$$R_2 = \frac{2.96(.012) + 2.91(.020)}{3.92} + .033 = .057$$

Panel 3

$$231C - 17D = 3.80$$

$$-23C + 134D = 4.12$$

Solving Simultaneously; $C = .019$, $D = .034$

$$R_3 = \frac{2.95(.019) + 2.90(.034)}{3.90} + .046 = .086$$

Panel 4

$$135D - 24E = -2.81$$

$$-24D + 94E = -2.81$$

Solving Simultaneously; $D = -.027$, $E = -.037$

$$R_4 = \frac{3(-.027) + 3(-.037)}{4} + (-.03) = -.078$$

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Panel 5

$$E = -.036$$

$$F = -.028$$

$$R_5 = -.078$$

Panel 6

$$F = +.020$$

$$G = -.012$$

$$R_6 = -.051$$

Panel 7

$$G = -.012$$

$$H = -.0069$$

$$R_7 = -.033$$

Panel 8

$$H = -.0081$$

$$I = -.0093$$

$$R_8 = -.026$$

Panel Constant Computations - Load at E

Panel 1

$$299A - 37B = 3.32$$

$$-52A + 400B = 3.59$$

$$A = .012, B = .011$$

$$R_1 = \frac{2.91(.012) + 2.83(.011)}{3.82} + .018 = .035$$

Panel 2

$$389B - 25C = 3.22$$

$$-34B + 238C = 3.49$$

$$B = .009, C = .016$$

$$R_2 = \frac{2.96(.009) + 2.91(.016)}{3.92} + .026 = .045$$

Panel 3

$$231C - 17D = 3.04$$

$$-23C + 134D = 3.30$$

$$C = .015, D = .027$$

$$R_3 = \frac{2.95(.015) + 2.90(.027)}{3.90} + .037 = .069$$

Panel 4

$$135D - 24E = 3.75$$

$$-24D + 94E = 3.75$$

$$D = .036, E = .049$$

$$R_4 = \frac{3(.036) + 3(.049)}{4} + .040 = .10$$

Panel 5

$$E = -.048$$

$$F = -.037$$

$$R_5 = -.104$$

Panel 6

$$F = -.027$$

$$G = -.016$$

$$R_6 = -.068$$

Panel 7

$$G = -.016$$

$$H = -.0092$$

$$R_7 = -.044$$

Panel 8

$$H = -.011$$

$$I = -.012$$

$$R_8 = -.035$$

Moment Determination

Load at PPl

$$M = K(A + \frac{B}{2} - R) \quad FM_{AB}$$

Panel 1

$$M_{AB} = 200(.022 + \frac{.019}{2} - .062) \quad M_{AB} = -6.0$$

$$M_{BA} = 200(.019 + \frac{.022}{2} - .062) \quad M_{BA} = -6.4$$

Panel 2

$$M_{BC} = 134(-.003 - \frac{.005}{2} + .015) \quad M_{BC} = +1.21$$

$$M_{CB} = 134(-.005 - \frac{.003}{2} + .015) \quad M_{CB} = +1.07$$

Panel 3

$$M_{CD} = 90(-.0055 - \frac{.0098}{2} + .024) \quad M_{CD} = +1.26$$

$$M_{DC} = 90(-.0098 - \frac{.0055}{2} + .024) \quad M_{DC} = +0.99$$

Panel 4

$$M_{DE} = 95(-.0092 - \frac{.012}{2} + .026) \quad M_{DE} = +1.05$$

$$M_{ED} = 95(-.012 - \frac{.0092}{2} + .026) \quad M_{ED} = +.86$$

Panel 5

$$M_{EF} = 2.58$$

$$M_{FE} = 2.97$$

Panel 6

$$M_{FG} = 2.16$$

$$M_{GF} = 2.70$$

Panel 7

$$M_{GH} = 2.40$$

$$M_{HG} = 2.82$$

Panel 8

$$M_{HI} = 2.76$$

$$M_{IH} = 2.58$$

1. The first part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved.

2. The second part of the paper describes the various methods that can be used to collect and analyze data. It discusses the advantages and disadvantages of each method and provides examples of how they can be applied in practice.

3. The third part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved.

4. The fourth part of the paper describes the various methods that can be used to collect and analyze data. It discusses the advantages and disadvantages of each method and provides examples of how they can be applied in practice.

5. The fifth part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved.

6. The sixth part of the paper describes the various methods that can be used to collect and analyze data. It discusses the advantages and disadvantages of each method and provides examples of how they can be applied in practice.

1. The first part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved.

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6. The sixth part of the paper describes the various methods that can be used to collect and analyze data. It discusses the advantages and disadvantages of each method and provides examples of how they can be applied in practice.

Load at PP2

Panel 1

$$M_{AB} = 200\left(.019 + \frac{.016}{2} - .053\right) \quad M_{AB} = -5.20$$

$$M_{BA} = 200\left(.016 + \frac{.019}{2} - .053\right) \quad M_{BA} = -5.40$$

Panel 2

$$M_{BC} = 134\left(.014 + \frac{.024}{2} - .067\right) \quad M_{BC} = -5.49$$

$$M_{CB} = 134\left(.024 + \frac{.014}{2} - .067\right) \quad M_{CB} = -4.82$$

Panel 3

$$M_{CD} = 90\left(-.011 - \frac{.020}{2} + .050\right) \quad M_{CD} = +2.61$$

$$M_{DC} = 90\left(-.020 - \frac{.011}{2} + .050\right) \quad M_{DC} = +2.16$$

Panel 4

$$M_{DE} = 95\left(-.018 - \frac{.025}{2} + .052\right) \quad M_{DE} = +2.09$$

$$M_{ED} = 95\left(-.025 - \frac{.018}{2} + .052\right) \quad M_{ED} = +1.71$$

Panel 5

$$M_{EF} = 3.44$$

$$M_{FE} = 3.96$$

Panel 6

$$M_{FG} = 2.88$$

$$M_{GF} = 3.60$$

Panel 7

$$M_{GH} = 3.20$$

$$M_{HG} = 3.76$$

Panel 8

$$M_{HI} = 3.68$$

$$M_{IH} = 3.44$$

1. 1. 1. 1.	1. 1. 1. 1.
2. 2. 2. 2.	2. 2. 2. 2.
3. 3. 3. 3.	3. 3. 3. 3.
4. 4. 4. 4.	4. 4. 4. 4.
5. 5. 5. 5.	5. 5. 5. 5.
6. 6. 6. 6.	6. 6. 6. 6.
7. 7. 7. 7.	7. 7. 7. 7.
8. 8. 8. 8.	8. 8. 8. 8.

1. 1. 1. 1.
 2. 2. 2. 2.
 3. 3. 3. 3.
 4. 4. 4. 4.
 5. 5. 5. 5.
 6. 6. 6. 6.
 7. 7. 7. 7.
 8. 8. 8. 8.

Load at PF3

Panel 1

$$M_{AB} = 200\left(.016 + \frac{.013}{2} - .044\right) \quad M_{AB} = -4.40$$

$$M_{BA} = 200\left(.013 + \frac{.016}{2} - .044\right) \quad M_{BA} = -4.60$$

Panel 2

$$M_{BC} = 134\left(.012 + \frac{.020}{2} - .057\right) \quad M_{BC} = -4.69$$

$$M_{CB} = 134\left(.020 + \frac{.012}{2} - .057\right) \quad M_{CB} = -4.15$$

Panel 3

$$M_{CD} = 90\left(.019 + \frac{.034}{2} - .086\right) \quad M_{CD} = -4.50$$

$$M_{DC} = 90\left(.034 + \frac{.019}{2} - .086\right) \quad M_{DC} = -3.78$$

Panel 4

$$M_{DE} = 95\left(-.027 - \frac{.037}{2} + .078\right) \quad M_{DE} = 3.14$$

$$M_{ED} = 95\left(-.037 - \frac{.027}{2} + .078\right) \quad M_{ED} = 2.56$$

Panel 5

$$M_{EF} = 95\left(-.012 - \frac{.0092}{2} + .026\right) \quad M_{EF} = .86$$

$$M_{FE} = 95\left(-.0092 - \frac{.012}{2} + .026\right) \quad M_{FE} = .99$$

Panel 6

$$M_{FG} = 90\left(-.0068 - \frac{.0039}{2} + .017\right) \quad M_{FG} = .72$$

$$M_{GF} = 90\left(-.0039 - \frac{.0068}{2} + .017\right) \quad M_{GF} = .90$$

Panel 7

$$M_{GH} = 134\left(-.0040 - \frac{.0023}{2} + .011\right) \quad M_{GH} = .80$$

$$M_{HG} = 134\left(-.0023 - \frac{.0040}{2} + .011\right) \quad M_{HG} = .94$$

Panel 8

$$M_{HI} = 200\left(-.0027 - \frac{.0031}{2} + .0088\right) \quad M_{HI} = .92$$

$$M_{IH} = 200\left(-.0031 - \frac{.0027}{2} + .0088\right) \quad M_{IH} = .86$$

Load at PF4

Panel 1

$$M_{AB} = 200\left(.012 + \frac{.011}{2} - .035\right)$$

$$M_{AB} = -3.40$$

$$M_{BA} = 200\left(.011 + \frac{.012}{2} - .035\right)$$

$$M_{BA} = -3.60$$

Panel 2

$$M_{BC} = 134\left(.009 + \frac{.016}{2} - .045\right)$$

$$M_{BC} = -3.75$$

$$M_{CB} = 134\left(.016 + \frac{.009}{2} - .045\right)$$

$$M_{CB} = -3.35$$

Panel 3

$$M_{CD} = 90\left(.015 + \frac{.027}{2} - .069\right)$$

$$M_{CD} = -3.69$$

$$M_{DC} = 90\left(.027 + \frac{.015}{2} - .069\right)$$

$$M_{DC} = -3.15$$

Panel 4

$$M_{DE} = 95\left(.036 + \frac{.049}{2} - 0.10\right)$$

$$M_{DE} = -3.80$$

$$M_{ED} = 95\left(.049 + \frac{.036}{2} - 0.10\right)$$

$$M_{ED} = -3.13$$

Panel 5

$$M_{EF} = 1.72$$

$$M_{FE} = 1.98$$

Panel 6

$$M_{FG} = 1.44$$

$$M_{GF} = 1.80$$

Panel 7

$$M_{GH} = 1.60$$

$$M_{HG} = 1.88$$

Panel 8

$$M_{HI} = 1.84$$

$$M_{IH} = 1.72$$

First Moment Corrections - Load at B

1 -

$$299A - 37B = 0$$

$$-52A + 400B = -1.21$$

$$A = -.00038$$

$$B = -.0031$$

$$R_1 = \frac{-2.91 \times .00038 - 2.83 \times .0031}{3.83} = -.0026$$

$$M_{AB} = 200(-.00038 - \frac{1}{2} \times .0031 + .0026) = 0.14$$

$$M_{BA} = 200(-.0031 - \frac{1}{2} \times .00038 + .0026) = -0.14$$

2 -

$$388B - 25C = 6.4$$

$$-34B + 238C = -1.26$$

$$B = .016$$

$$C = -.0030$$

$$R_2 = \frac{2.96 \times .016 - 2.91 \times .003}{3.91} = .0099$$

$$M_{BC} = 134(.016 - \frac{1}{2} \times .0030 - .0099) = 0.62$$

$$M_{CB} = 134(-.0030 + \frac{1}{2} \times .016 - .0099) = -0.66$$

3

$$271C - 17D = -1.07$$

$$-23C + 134D = -1.05$$

$$C = -.0055$$

$$D = -.0088$$

$$R_3 = \frac{-2.95 \times .0055 - 2.90 \times .0088}{3.90} = -.011$$

$$M_{CD} = 90(-.0055 - \frac{1}{2} \times .0088 + .011) = 0.072$$

$$M_{DC} = 90(-.0088 - \frac{1}{2} \times .0055 + .011) = -0.072$$

4 -

$$94D - 24E = -.99$$

$$-24D + 135E = -.86$$

$$D = -.013$$

$$E = -.0086$$

$$R_4 = \frac{3}{4}(-.013 - .0086) = -.016$$

$$M_{DE} = 95(-.013 - \frac{1}{2}x.0086 + .016) = -.10$$

$$M_{ED} = 95(-.0086 - \frac{1}{2}x.013 + .016) = +.10$$

5 -

$$135E - 24F = -.86$$

$$-24E + 94F = -.72$$

$$E = -.0080$$

$$F = -.0097$$

$$R_5 = \frac{3}{4}(-.0080 - .0097) = -.013$$

$$M_{EF} = 95(-.0080 - \frac{1}{2}x.0097 + .013) = .05$$

$$M_{FE} = 95(-.0097 - \frac{1}{2}x.0080 + .013) = -.04$$

6 -

$$134F - 23G = -.99$$

$$-17F + 231G = -.80$$

$$F = -.0079$$

$$G = -.0040$$

$$R_6 = \frac{-2.90x.0079 - 2.95x.0040}{3.90} = -.0090$$

$$M_{FG} = 90(-.0079 - \frac{1}{2}x.0040 + .0090) = -.08$$

$$M_{GF} = 90(-.0040 - \frac{1}{2}x.0079 + .0090) = .09$$

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7 -

$$238G - 34H = -.90$$

$$-25G + 388H = -.92$$

$$G = -.0040$$

$$H = -.0026$$

$$R_7 = \frac{-2.91 \times .0040 - 2.96 \times .0026}{3.91} = -.0049$$

$$M_{GH} = 134(-.0040 - \frac{1}{2} \times .0026 + .0049) = -.05$$

$$M_{HG} = 134(-.0026 - \frac{1}{2} \times .0040 + .0049) = .04$$

8 -

$$400H - 52I = -.94$$

$$-37H + 299I = 0.00$$

$$H = -.0024$$

$$I = -.0003$$

$$R_8 = \frac{-2.83 \times .0024 - 2.91 \times .0003}{3.83} = -.0020$$

$$M_{HI} = 200(-.0024 - \frac{1}{2} \times .0003 + .0020) = -0.10$$

$$M_{IH} = 200(-.0003 - \frac{1}{2} \times .0024 + .0020) = 0.10$$

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Load at B

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	5.82	6.28	-1.11	-1.21	-1.10	-1.19	- .94	- .94
α	.022	.019	-.003	-.005	-.0055	-.0098	-.0092	-.012
R	.062		-.015		-.024		-.026	
M'	-6.0	-6.4	1.21	1.07	1.26	0.99	1.05	0.86
-Q	0.00	-1.21	6.4	-1.26	-1.07	-1.05	-0.99	-0.86
α	-.0004	.0031	0.16	-.0030	-.0055	-.0088	-.013	-.0086
R	-.0026		-.0099		-.011		-.016	
M''	0.14	-0.14	0.62	-0.66	0.07	-0.07	- .10	.10
-Q								
α								
R								
M'''								
M	-5.86	-6.54	1.83	0.41	1.33	0.92	0.95	0.96

Name		Address		Occupation	
John	Smith	123 Main St	New York	Merchant	
James	Johnson	456 Elm St	Chicago	Engineer	
William	Brown	789 Oak St	Philadelphia	Lawyer	
Robert	Wilson	101 Pine St	Boston	Doctor	
Thomas	Miller	202 Cedar St	San Francisco	Miner	
Charles	Davis	303 Birch St	Portland	Teacher	
Edward	Clark	404 Spruce St	Seattle	Farmer	
George	White	505 Ash St	Denver	Banker	
Henry	Green	606 Hickory St	St. Louis	Artist	
Benjamin	Black	707 Walnut St	San Diego	Merchant	
Samuel	Gray	808 Chestnut St	San Antonio	Engineer	
Joseph	King	909 Elm St	San Jose	Lawyer	
Richard	Wright	1010 Oak St	San Francisco	Miner	
David	Scott	1111 Pine St	San Francisco	Teacher	
John	Lee	1212 Cedar St	San Francisco	Farmer	
James	Young	1313 Birch St	San Francisco	Banker	
William	Allen	1414 Spruce St	San Francisco	Artist	
Robert	Evans	1515 Ash St	San Francisco	Merchant	
Thomas	Roberts	1616 Hickory St	San Francisco	Engineer	
Charles	Turner	1717 Walnut St	San Francisco	Lawyer	
Edward	Phillips	1818 Chestnut St	San Francisco	Miner	
George	Campbell	1919 Elm St	San Francisco	Teacher	
Henry	Stewart	2020 Oak St	San Francisco	Farmer	
Benjamin	Cooper	2121 Pine St	San Francisco	Banker	
Samuel	Rice	2222 Cedar St	San Francisco	Artist	
Joseph	Ward	2323 Birch St	San Francisco	Merchant	
Richard	Green	2424 Spruce St	San Francisco	Engineer	
David	Black	2525 Ash St	San Francisco	Lawyer	
John	White	2626 Hickory St	San Francisco	Miner	
James	Gray	2727 Walnut St	San Francisco	Teacher	
William	King	2828 Chestnut St	San Francisco	Farmer	
Robert	Wright	2929 Elm St	San Francisco	Banker	
Thomas	Scott	3030 Oak St	San Francisco	Artist	
Charles	Lee	3131 Pine St	San Francisco	Merchant	
Edward	Young	3232 Cedar St	San Francisco	Engineer	
George	Allen	3333 Birch St	San Francisco	Lawyer	
Henry	Evans	3434 Spruce St	San Francisco	Miner	
Benjamin	Roberts	3535 Ash St	San Francisco	Teacher	
Samuel	Phillips	3636 Hickory St	San Francisco	Farmer	
Joseph	Campbell	3737 Walnut St	San Francisco	Banker	
Richard	Rice	3838 Chestnut St	San Francisco	Artist	
David	Ward	3939 Elm St	San Francisco	Merchant	
John	Green	4040 Oak St	San Francisco	Engineer	
James	Black	4141 Pine St	San Francisco	Lawyer	
William	White	4242 Cedar St	San Francisco	Miner	
Robert	Gray	4343 Birch St	San Francisco	Teacher	
Thomas	King	4444 Spruce St	San Francisco	Farmer	
Charles	Wright	4545 Ash St	San Francisco	Banker	
Edward	Scott	4646 Hickory St	San Francisco	Artist	
George	Lee	4747 Walnut St	San Francisco	Merchant	
Henry	Young	4848 Chestnut St	San Francisco	Engineer	
Benjamin	Allen	4949 Elm St	San Francisco	Lawyer	
Samuel	Evans	5050 Oak St	San Francisco	Miner	
Joseph	Roberts	5151 Pine St	San Francisco	Teacher	
Richard	Phillips	5252 Cedar St	San Francisco	Farmer	
David	Campbell	5353 Birch St	San Francisco	Banker	
John	Rice	5454 Spruce St	San Francisco	Artist	
James	Ward	5555 Ash St	San Francisco	Merchant	
William	Green	5656 Hickory St	San Francisco	Engineer	
Robert	Black	5757 Walnut St	San Francisco	Lawyer	
Thomas	White	5858 Chestnut St	San Francisco	Miner	
Charles	Gray	5959 Elm St	San Francisco	Teacher	
Edward	King	6060 Oak St	San Francisco	Farmer	
George	Wright	6161 Pine St	San Francisco	Banker	
Henry	Scott	6262 Cedar St	San Francisco	Artist	
Benjamin	Lee	6363 Birch St	San Francisco	Merchant	
Samuel	Young	6464 Spruce St	San Francisco	Engineer	
Joseph	Allen	6565 Ash St	San Francisco	Lawyer	
Richard	Evans	6666 Hickory St	San Francisco	Miner	
David	Roberts	6767 Walnut St	San Francisco	Teacher	
John	Phillips	6868 Chestnut St	San Francisco	Farmer	
James	Campbell	6969 Elm St	San Francisco	Banker	
William	Rice	7070 Oak St	San Francisco	Artist	
Robert	Ward	7171 Pine St	San Francisco	Merchant	
Thomas	Green	7272 Cedar St	San Francisco	Engineer	
Charles	Black	7373 Birch St	San Francisco	Lawyer	
Edward	White	7474 Spruce St	San Francisco	Miner	
George	Gray	7575 Ash St	San Francisco	Teacher	
Henry	King	7676 Hickory St	San Francisco	Farmer	
Benjamin	Wright	7777 Walnut St	San Francisco	Banker	
Samuel	Scott	7878 Chestnut St	San Francisco	Artist	
Joseph	Lee	7979 Elm St	San Francisco	Merchant	
Richard	Young	8080 Oak St	San Francisco	Engineer	
David	Allen	8181 Pine St	San Francisco	Lawyer	
John	Evans	8282 Cedar St	San Francisco	Miner	
James	Roberts	8383 Birch St	San Francisco	Teacher	
William	Phillips	8484 Spruce St	San Francisco	Farmer	
Robert	Campbell	8585 Ash St	San Francisco	Banker	
Thomas	Rice	8686 Hickory St	San Francisco	Artist	
Charles	Ward	8787 Walnut St	San Francisco	Merchant	
Edward	Green	8888 Chestnut St	San Francisco	Engineer	
George	Black	8989 Elm St	San Francisco	Lawyer	
Henry	White	9090 Oak St	San Francisco	Miner	
Benjamin	Gray	9191 Pine St	San Francisco	Teacher	
Samuel	King	9292 Cedar St	San Francisco	Farmer	
Joseph	Wright	9393 Birch St	San Francisco	Banker	
Richard	Scott	9494 Spruce St	San Francisco	Artist	
David	Lee	9595 Ash St	San Francisco	Merchant	
John	Young	9696 Hickory St	San Francisco	Engineer	
James	Allen	9797 Walnut St	San Francisco	Lawyer	
William	Evans	9898 Chestnut St	San Francisco	Miner	
Robert	Roberts	9999 Elm St	San Francisco	Teacher	

5		6		7		8	
E	F	F	G	G	H	H	I
-0.94	-0.94	-0.82	-0.76	-0.87	-0.81	-0.90	-0.83
-0.12	-.0092	-.0068	-.0039	-.0040	-.0023	-.0027	-.0031
-.026		-.017		-.011		-.0088	
0.86	0.99	0.72	0.90	0.80	0.94	0.92	0.86
-0.86	-0.72	-0.99	-0.80	-0.90	-0.92	-0.94	0.00
-.0080	-.0097	-.0079	-.0040	-.0040	-.0026	-.0024	-.0003
-.013		-.0090		-.0049		-.0020	
.05	-.04	-.08	.09	-.05	.04	-.10	.10
0.91	0.95	0.64	0.99	0.75	0.98	0.82	0.96

First Moment Corrections - Load at C

$$1. \quad \begin{aligned} 299A - 37B &= 0 \\ -52A + 400B &= 5.49' \end{aligned}$$

$$\begin{aligned} A &= .0017 \\ B &= .014 \\ R_1 &= \frac{2.91 \times .0017 + 2.83 \times .014}{3.83} = .012 \end{aligned}$$

$$\begin{aligned} M_{AB} &= 200(.0017 + \frac{1}{2} \times .014 - .012) = -.60 \\ M_{BA} &= 200(.014 + \frac{1}{2} \times .0017 - .012) = .60 \end{aligned}$$

$$2. \quad \begin{aligned} 388B - 25C &= 5.40 \\ -34B + 238C &= -2.61 \end{aligned}$$

$$\begin{aligned} B &= .013 \\ C &= -.0091 \\ R_2 &= \frac{2.96 \times .013 - 2.91 \times .0091}{3.91} = .0031 \end{aligned}$$

$$\begin{aligned} M_{BC} &= 134(.013 - \frac{1}{2} \times .0091 - .0031) = .67 \\ M_{CB} &= 134(-.0091 + \frac{1}{2} \times .013 - .0031) = -.71 \end{aligned}$$

$$3. \quad \begin{aligned} 231C - 17D &= 4.82 \\ -23C + 134D &= -2.09 \end{aligned}$$

$$\begin{aligned} C &= .020 \\ D &= .012 \\ R_3 &= \frac{2.95 \times .02 - 2.90 \times .012}{3.90} = .0062 \end{aligned}$$

$$\begin{aligned} M_{CD} &= 90(.020 - \frac{1}{2} \times .012 - .0062) = .72 \\ M_{DC} &= 90(-.012 + \frac{1}{2} \times .020 - .0062) = -.72 \end{aligned}$$

$$4. \quad \begin{aligned} 94D - 24E &= -2.16 \\ -24D + 135E &= -1.72 \end{aligned}$$

$$\begin{aligned} D &= -.028 \\ E &= .018 \\ R_4 &= \frac{3}{4} (-.028 - .018) = -.035 \\ M_{DE} &= 95(-.028 - \frac{1}{2} \times .018 + .035) = -.23 \\ M_{ED} &= 95(-.018 - \frac{1}{2} \times .028 + .035) = .23 \end{aligned}$$

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5.

$$\begin{aligned}
 135E - 24F &= -1.71 \\
 -24E + 94F &= -1.44 \\
 E &= -.016 \\
 F &= -.019
 \end{aligned}$$

$$R_5 = \frac{3}{4} (-.016 - .019) = -.026$$

$$M_{EF} = 95(-.016 - \frac{1}{2} \times .019 + .026) = .10$$

$$M_{FE} = 95(-.016 - \frac{1}{2} \times .019 + .026) = -.10$$

6.

$$\begin{aligned}
 134F - 23G &= -1.98 \\
 -17F + 231G &= -1.60 \\
 F &= -.016 \\
 G &= -.008
 \end{aligned}$$

$$R_6 = \frac{-2.90 \times .008 - 2.95 \times .016}{3.90} = -.018$$

$$M_{FG} = 90(-.016 - \frac{1}{2} \times .008 + .018) = -.18$$

$$M_{GF} = 90(-.008 - \frac{1}{2} \times .016 + .018) = .18$$

7.

$$\begin{aligned}
 238G - 34H &= -1.80 \\
 -25G + 388H &= -1.84 \\
 G &= .0080 \\
 H &= .0052
 \end{aligned}$$

$$R_7 = \frac{-2.91 \times .0080 - 2.96 \times .0052}{3.91} = -.0098$$

$$M_{GH} = 134(-.0080 - \frac{1}{2} \times .0052 + .0098) = -.09$$

$$M_{HG} = 134(-.0080 - \frac{1}{2} \times .0052 + .0098) = .09$$

8.

$$\begin{aligned}
 400H - 52I &= -1.88 \\
 -37H + 299I &= 0 \\
 H &= -.0049 \\
 I &= -.0006
 \end{aligned}$$

$$R_8 = \frac{-2.83 \times .0049 - 2.91 \times .0006}{3.83} = -.0040$$

$$M_{HI} = 200(-.0049 - \frac{1}{2} \times .0006 + .0040) = -.20$$

$$M_{IH} = 200(-.0006 - \frac{1}{2} \times .0049 + .0040) = .20$$

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Second Moment Corrections-Load at C

1.

$$\begin{aligned} 299A - 37B &= 0 \\ -52A + 400B &= -.67 \\ A &= -.0002 \\ B &= -.0017 \end{aligned}$$

$$R_1 = \frac{-2.91 \times .0002 - 2.83 \times .0017}{3.83} = -.0014$$

$$M_{AB} = 200(-.0002 - \frac{1}{2} \times .0017 + .0014) = .08$$

$$M_{BA} = 200(-.0017 - \frac{1}{2} \times .0002 + .0014) = -.08$$

2.

$$\begin{aligned} 388B - 25C &= -.67 \\ -34B + 238C &= -.72 \\ B &= -.0020 \\ C &= -.0033 \end{aligned}$$

$$R_2 = \frac{-2.96 \times .0020 - 2.91 \times .0033}{3.91} = -.0040$$

$$M_{BC} = 134(-.0020 - \frac{1}{2} \times .0033 + .0040) = .05$$

$$M_{CB} = 134(-.0033 - \frac{1}{2} \times .0020 + .0040) = -.04$$

3.

$$\begin{aligned} 231C - 17D &= .71 \\ -23C + 134D &= .23 \\ C &= .0023 \\ D &= .0033 \end{aligned}$$

$$R_3 = \frac{2.95 \times .0023 + 2.90 \times .0033}{3.90} = .0042$$

$$M_{CD} = 90(.0023 + \frac{1}{2} \times .0033 - .0042) = -.03$$

$$M_{DC} = 90(.0033 + \frac{1}{2} \times .0023 - .0042) = .03$$

4.

$$\begin{aligned} 94D - 24E &= .72 \\ -24D + 135E &= -.10 \\ D &= .0076 \\ E &= .0006 \end{aligned}$$

$$R_4 = \frac{3}{4} (.0076 + .0006) = .0062$$

$$M_{DE} = 95(.0076 + \frac{1}{2} \times .0006 - .0062) = .16$$

$$M_{ED} = 95(.0006 + \frac{1}{2} \times .0076 - .0062) = -.16$$

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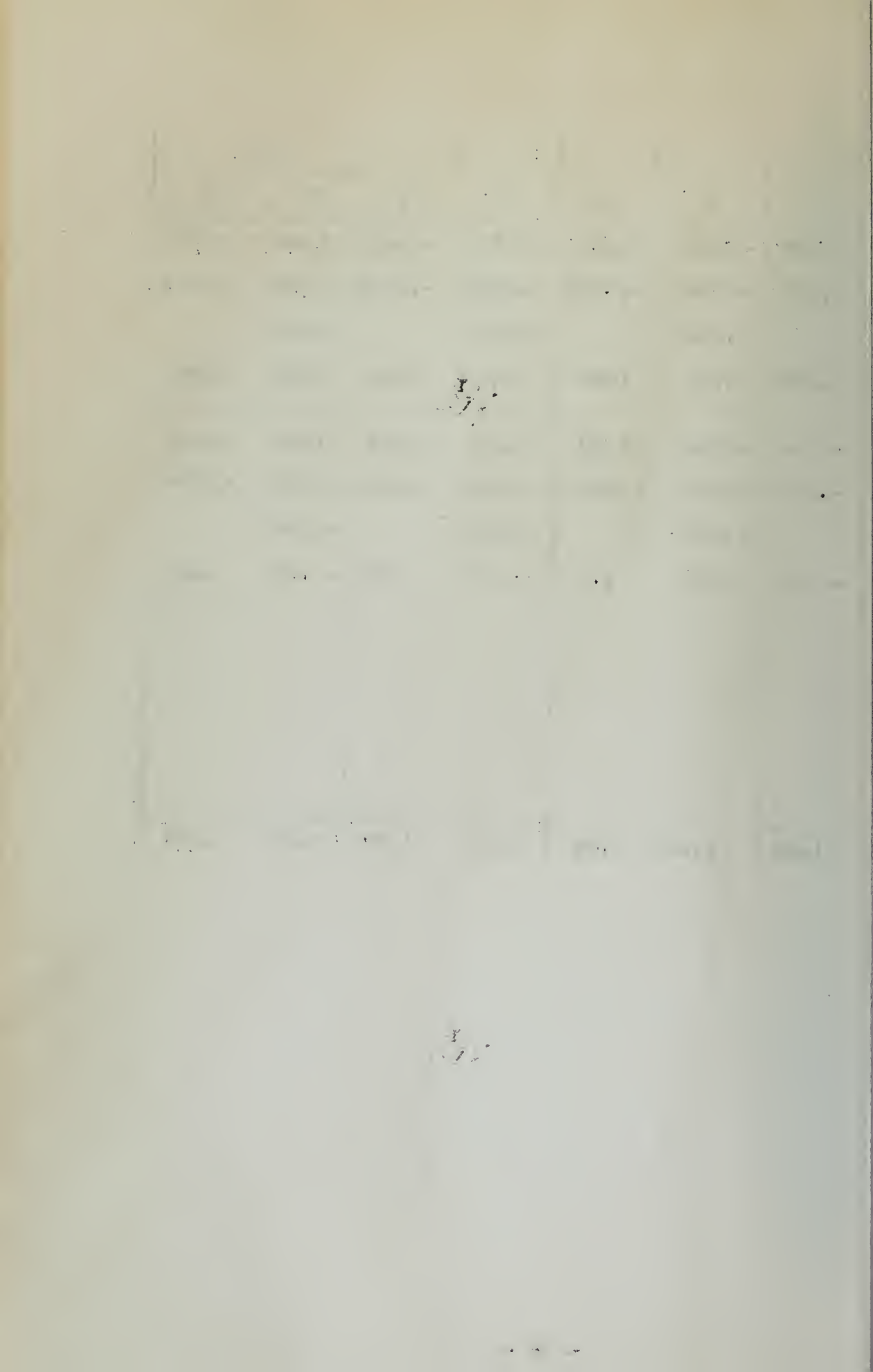
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Load at C

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
Q	4.98	5.38	4.82	5.24	-2.20	-2.39	-1.87	-1.87
X	.019	.016	.014	.024	-.011	-.020	-.018	-.025
R	.053		.067		-.050		-.052	
M'	-5.20	-5.40	-5.49	-4.82	2.61	2.16	2.09	1.71
Q	0.00	5.49	5.40	-2.61	4.82	-2.09	-2.16	-1.72
X	.0017	.014	.013	-.0091	.020	-0.12	-0.28	-.018
R	.012		-.0031		.0062		-.035	
M''	-.60	.60	.67	-.71	.72	-.72	-.23	.23
Q	0.00	-.67	-.67	-.72	.71	.23	.72	-.10
X	-.0002	-.0017	-.0020	-.0033	.0023	.0033	.0076	.0006
R	-.0014		-.0040		.0042		.0062	
M'''	.08	-.08	.05	-.04	-.03	.03	.16	-.16
M	-5.72	-4.88	-4.77	-5.57	3.29	1.47	2.02	1.78

Jan 1	1887	Jan 1	1887	Jan 1	1887	Jan 1	1887
Jan 2	1887	Jan 2	1887	Jan 2	1887	Jan 2	1887
Jan 3	1887	Jan 3	1887	Jan 3	1887	Jan 3	1887
Jan 4	1887	Jan 4	1887	Jan 4	1887	Jan 4	1887
Jan 5	1887	Jan 5	1887	Jan 5	1887	Jan 5	1887
Jan 6	1887	Jan 6	1887	Jan 6	1887	Jan 6	1887
Jan 7	1887	Jan 7	1887	Jan 7	1887	Jan 7	1887
Jan 8	1887	Jan 8	1887	Jan 8	1887	Jan 8	1887
Jan 9	1887	Jan 9	1887	Jan 9	1887	Jan 9	1887
Jan 10	1887	Jan 10	1887	Jan 10	1887	Jan 10	1887
Jan 11	1887	Jan 11	1887	Jan 11	1887	Jan 11	1887
Jan 12	1887	Jan 12	1887	Jan 12	1887	Jan 12	1887
Jan 13	1887	Jan 13	1887	Jan 13	1887	Jan 13	1887
Jan 14	1887	Jan 14	1887	Jan 14	1887	Jan 14	1887
Jan 15	1887	Jan 15	1887	Jan 15	1887	Jan 15	1887
Jan 16	1887	Jan 16	1887	Jan 16	1887	Jan 16	1887
Jan 17	1887	Jan 17	1887	Jan 17	1887	Jan 17	1887
Jan 18	1887	Jan 18	1887	Jan 18	1887	Jan 18	1887
Jan 19	1887	Jan 19	1887	Jan 19	1887	Jan 19	1887
Jan 20	1887	Jan 20	1887	Jan 20	1887	Jan 20	1887
Jan 21	1887	Jan 21	1887	Jan 21	1887	Jan 21	1887
Jan 22	1887	Jan 22	1887	Jan 22	1887	Jan 22	1887
Jan 23	1887	Jan 23	1887	Jan 23	1887	Jan 23	1887
Jan 24	1887	Jan 24	1887	Jan 24	1887	Jan 24	1887
Jan 25	1887	Jan 25	1887	Jan 25	1887	Jan 25	1887
Jan 26	1887	Jan 26	1887	Jan 26	1887	Jan 26	1887
Jan 27	1887	Jan 27	1887	Jan 27	1887	Jan 27	1887
Jan 28	1887	Jan 28	1887	Jan 28	1887	Jan 28	1887
Jan 29	1887	Jan 29	1887	Jan 29	1887	Jan 29	1887
Jan 30	1887	Jan 30	1887	Jan 30	1887	Jan 30	1887
Jan 31	1887	Jan 31	1887	Jan 31	1887	Jan 31	1887

5		6		7		8	
E	F	F	G	G	H	H	I
-1.88	-1.88	-1.64	-1.52	-1.74	-1.62	-1.80	-1.66
-.024	-.018	-.014	-.0078	-.0080	-.0046	-.0054	-.0062
-.052		-.034		-.022		-.018	
1.72	1.98	1.44	1.80	1.60	1.88	1.84	1.72
-1.71	-1.44	-1.98	-1.60	-1.80	-1.84	-1.88	0.00
-.016	-.019	-.016	-.008	-.0080	-.0052	-.0049	-.0006
-.026		-.018		-.0098		-.0042	
.10	- .10	- .18	.18	- .09	.09	- .20	.20
1.82	1.88	1.26	1.98	1.51	1.97	1.64	1.92



Influence Lines - First Correction

Load at D

Panel 1

$$299A - 37B = 0$$

$$-52A + 400B = 4.69$$

$$A = .001$$

$$B = .012$$

$$R_1 = .010$$

$$M_{AB} = 200(.001 + \frac{1}{2}x.012 - .01) = -.60$$

$$M_{BA} = 200(.012 + \frac{1}{2}x.001 - .01) = .60$$

Panel 2

$$389B - 25C = 4.60$$

$$-34B + 238C = 4.50$$

$$B = .013$$

$$C = .021$$

$$R_2 = .025$$

$$M_{BC} = 134(.013 + \frac{1}{2}x.021 - .025) = -.27$$

$$M_{CB} = 134(.021 + \frac{1}{2}x.013 - .025) = .27$$

Panel 3

$$231C - 17D = 4.15$$

$$-23C + 134D = -3.14$$

$$C = .016$$

$$D = -.021$$

$$R_3 = -.003$$

$$M_{CD} = 90(.016 - \frac{1}{2}x.021 + .003) = .81$$

$$M_{DC} = 90(-.021 + \frac{1}{2}x.016 + .003) = -.90$$

Panel 4

$$135D - 24E = 3.78$$

$$-24D + 94E = -2.58$$

$$D = .024$$

$$E = -.021$$

$$R_4 = .002$$

$$M_{DE} = 95(.024 - \frac{1}{2}x.021 - .002) = 1.14$$

$$M_{ED} = 95(-.021 + \frac{1}{2}x.024 - .002) = -1.04$$

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Panel 5

$$-24F + 94E = -2.56$$

$$135F - 24E = -2.16$$

$$E = -.033$$

$$F = -.022$$

$$R_5 = -.041$$

$$M_{EF} = 95(-.033 - \frac{1}{2}x.022 + .041) = -.28$$

$$M_{FE} = 95(-.022 - \frac{1}{2}x.033 + .041) = .28$$

Panel 6

$$-23G + 134F = -2.97$$

$$231G - 17F = -2.40$$

$$F = -.024$$

$$G = -.012$$

$$R_6 = -.027$$

$$M_{FG} = 90(-.024 - \frac{1}{2}x.012 + .027) = -.27$$

$$M_{GF} = 90(-.012 - \frac{1}{2}x.024 + .027) = .27$$

Panel 7

$$-34H + 238G = -2.70$$

$$389H - 25G = -2.76$$

$$G = -.012$$

$$H = -.008$$

$$R_7 = -.015$$

$$M_{GH} = 134(-.012 - \frac{1}{2}x.008 + .015) = -.13$$

$$M_{HG} = 134(-.008 - \frac{1}{2}x.012 + .015) = .13$$

Panel 8

$$-52I + 400H = -2.82$$

$$299I - 37H = 0$$

$$H = -.001$$

$$I = -.007$$

$$R_8 = -.005$$

$$M_{HI} = 200(0 - \frac{1}{2}x.007 + .005) = .40$$

$$M_{IH} = 200(-.007 - \frac{1}{2}x0 + .005) = -.40$$

1. $\sigma_1 = 1$
 2. $\sigma_2 = 1$
 3. $\sigma_3 = 1$
 4. $\sigma_4 = 1$
 5. $\sigma_5 = 1$

6. $\sigma_6 = 1$
 7. $\sigma_7 = 1$

8. $\sigma_8 = 1$
 9. $\sigma_9 = 1$
 10. $\sigma_{10} = 1$
 11. $\sigma_{11} = 1$

12. $\sigma_{12} = 1$
 13. $\sigma_{13} = 1$

14. $\sigma_{14} = 1$
 15. $\sigma_{15} = 1$
 16. $\sigma_{16} = 1$
 17. $\sigma_{17} = 1$

18. $\sigma_{18} = 1$
 19. $\sigma_{19} = 1$

20. $\sigma_{20} = 1$
 21. $\sigma_{21} = 1$
 22. $\sigma_{22} = 1$
 23. $\sigma_{23} = 1$

24. $\sigma_{24} = 1$
 25. $\sigma_{25} = 1$

Influence Lines - Second Correction - Load at D

Panel 1

$$299A - 37B = 0$$

$$-53A + 400B = .27$$

$$A = 0$$

$$B = .0007$$

$$R_1 = 0$$

$$M_{AB} = 0$$

$$M_{BA} = 0$$

Panel 2

$$389B - 25C = -.60$$

$$-34B + 238C = -.81$$

$$B = -.0018$$

$$C = -.0037$$

$$R_2 = -.0041$$

$$M_{BC} = 134(-.0018 - \frac{1}{2}x.0037 + .0041) = .07$$

$$M_{CB} = 134(-.0037 - \frac{1}{2}x.0018 + .0041) = -.07$$

Panel 3

$$231C - 17D = -.27$$

$$-.23C + 134D = -1.14$$

$$C = -.0019$$

$$D = -.0088$$

$$R_3 = -.0080$$

$$M_{CD} = 90(-.0019 - \frac{1}{2}x.0088 + .0080) = .15$$

$$M_{DC} = 90(-.0088 - \frac{1}{2}x.0019 + .0080) = -.15$$

Panel 4

$$135D - 24E = .90$$

$$-24D + 94E = .28$$

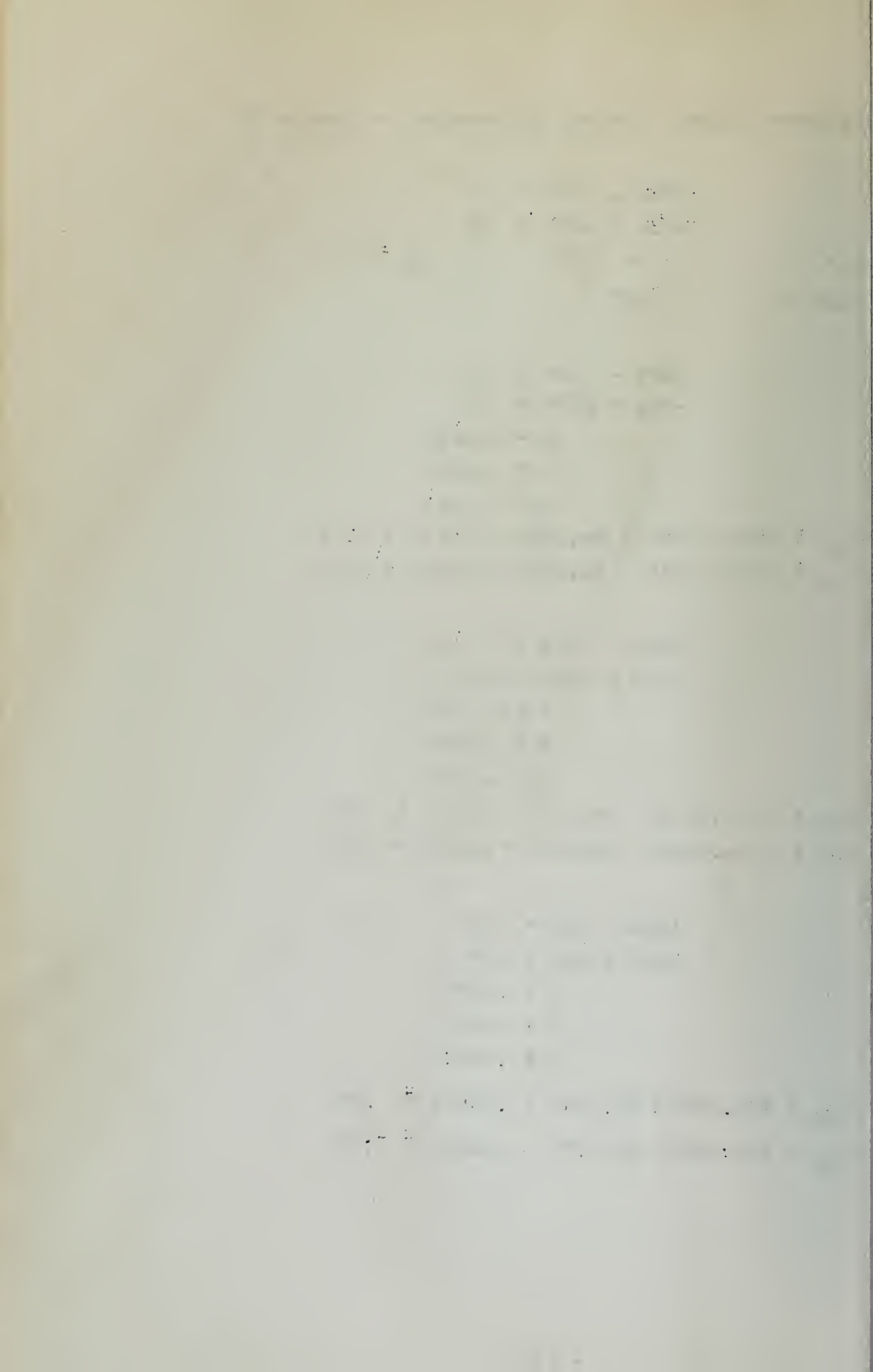
$$D = .0076$$

$$E = .0049$$

$$R_4 = .0094$$

$$M_{DE} = 95(.0076 + \frac{1}{2}x.0049 - .0094) = .07$$

$$M_{ED} = 95(.0049 + \frac{1}{2}x.0076 - .0094) = -.07$$



Panel 5

$$-24F + 94E = 1.04$$

$$135F - 24E = .27$$

$$E = .0121$$

$$F = .0042$$

$$R_5 = .0122$$

$$M_{EF} = 95(.0121 + \frac{1}{2} \times .0042 - .0122) = .19$$

$$M_{FE} = 95(.0042 + \frac{1}{2} \times .0121 - .0122) = -.19$$

Panel 6

$$-23G + 134F = -.28$$

$$231G - 17F = .13$$

$$F = -.0020$$

$$G = .0004$$

$$R_6 = -.0012$$

$$M_{FG} = 90(-.0020 + \frac{1}{2} \times .0004 + .0012) = -.05$$

$$M_{GF} = 90(.0004 - \frac{1}{2} \times .0020 + .0012) = .05$$

Panel 7

$$-34H + 238G = -.27$$

$$389H - 25G = -.40$$

$$G = -.0013$$

$$H = -.0011$$

$$R_7 = -.0018$$

$$M_{GH} = 134(-.0013 - \frac{1}{2} \times .0011 + .0018) = 0$$

$$M_{HG} = 134(-.0011 - \frac{1}{2} \times .0013 + .0018) = 0$$

Panel 8

$$-52I + 400H = -.13$$

$$299I - 37H = 0$$

$$H = -.0003$$

$$R_8 = 0$$

$$M_{IH} = 0$$

$$I = 0$$

$$M_{HI} = 0$$

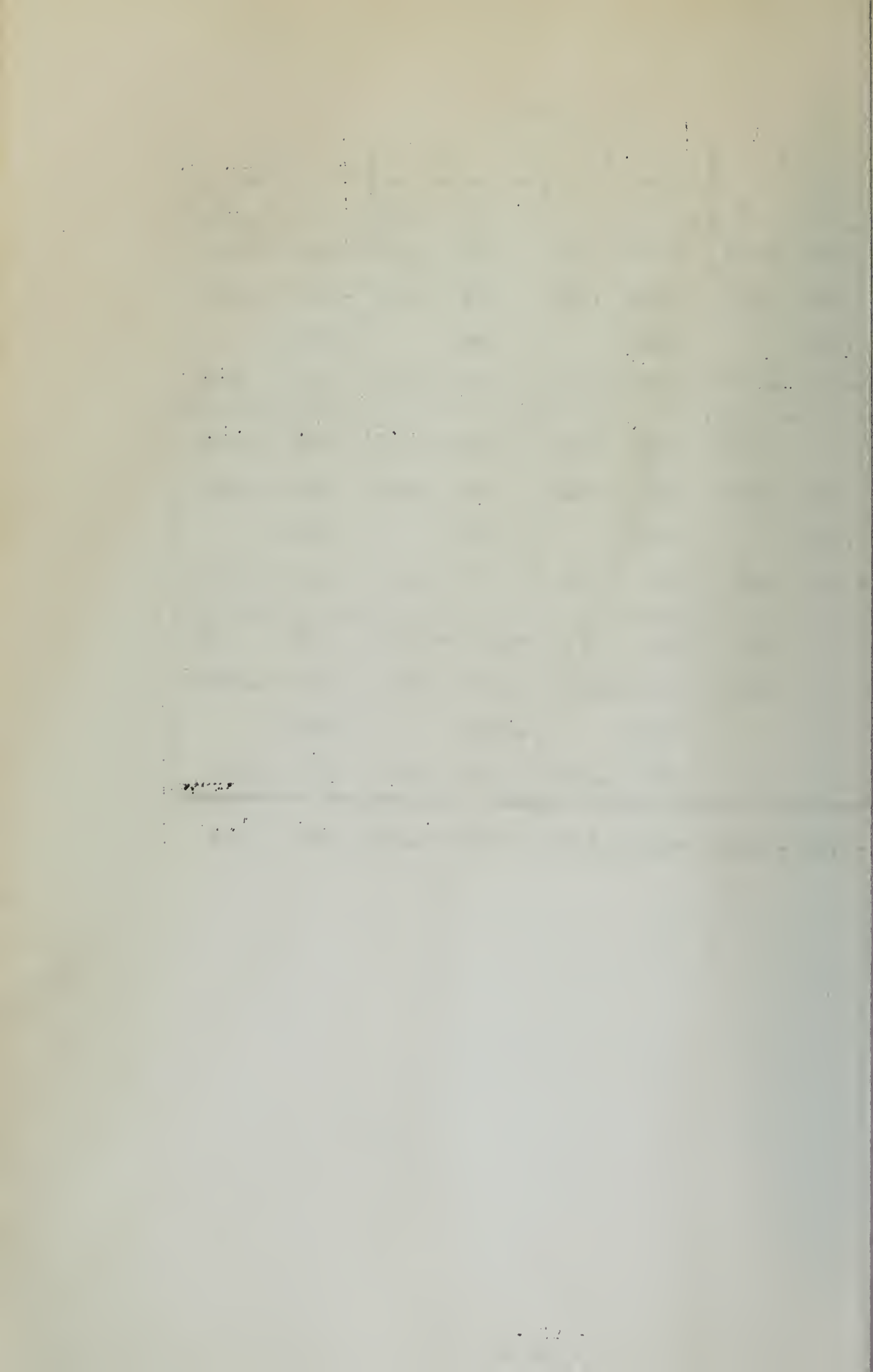
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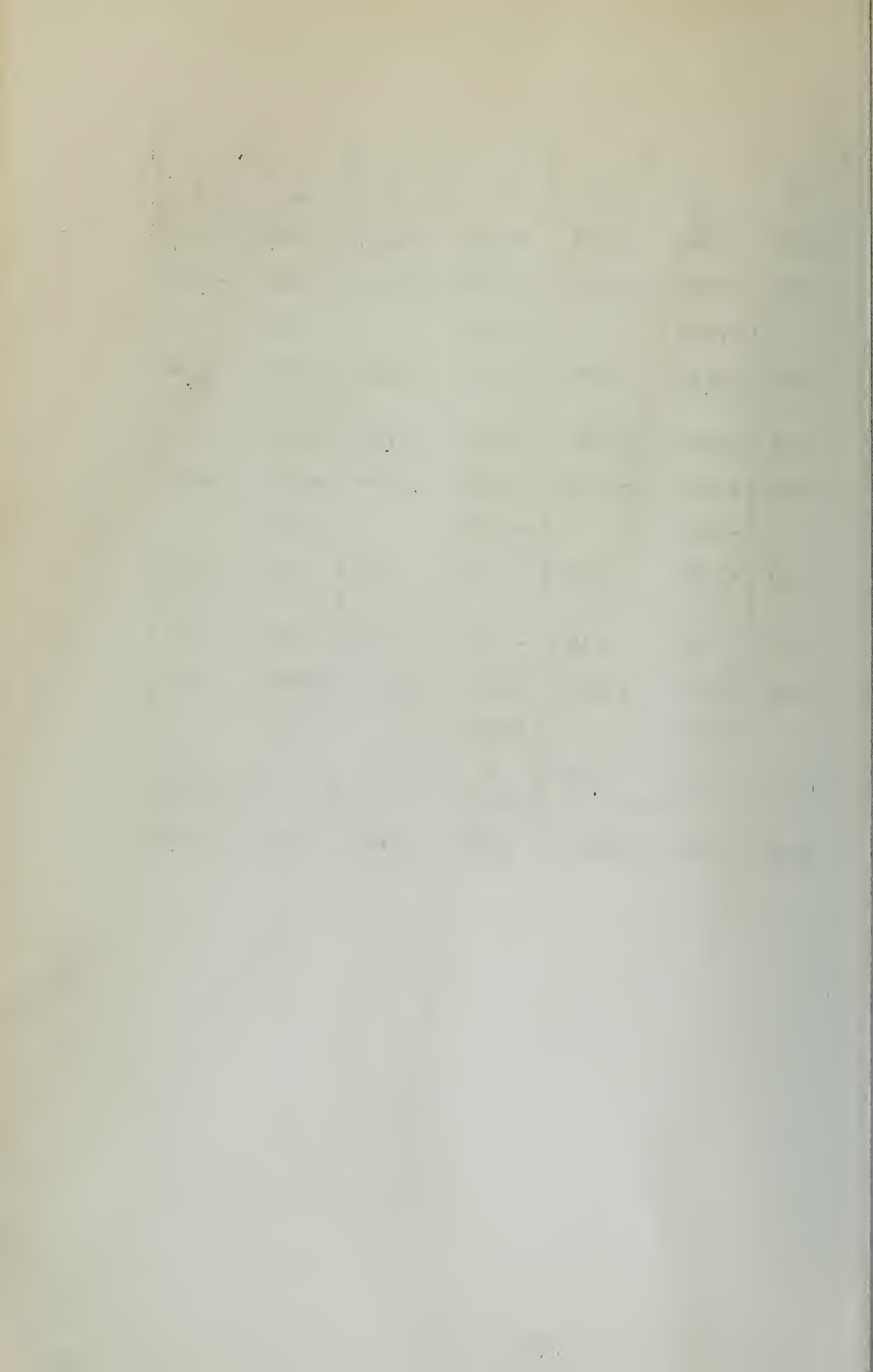
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Load at PP3

| Panel | 1 | | 2 | | 3 | | 4 | |
|----------|-------|-------|--------|--------|--------|--------|-------|-------|
| Joint | A | B | B | C | C | D | D | E |
| -Q | 4.15 | 4.49 | 4.02 | 4.36 | 3.80 | 4.12 | -2.88 | -2.81 |
| α | .016 | .013 | .012 | .020 | .019 | .034 | -.027 | -.037 |
| R | .044 | | .057 | | .086 | | -.078 | |
| M' | -4.40 | -4.60 | -4.69 | -4.15 | -4.50 | -3.78 | 3.14 | 2.56 |
| -Q | 0 | 4.69 | 4.60 | 4.50 | 4.15 | -3.14 | 3.78 | -2.58 |
| α | .001 | .012 | .031 | .021 | .016 | -.021 | .024 | -.021 |
| R | .010 | | .025 | | -.003 | | .002 | |
| M'' | -.60 | .60 | -.27 | .27 | .81 | -.90 | 1.14 | -1.04 |
| -Q | 0 | .27 | -.60 | -.81 | -.27 | -1.14 | .90 | .28 |
| α | 0 | .0007 | -.0018 | -.0037 | -.0019 | -.0083 | .0076 | .0049 |
| R | 0 | | -.0041 | | -.0080 | | .0094 | |
| M''' | 0 | 0 | .07 | -.07 | .15 | -.15 | .07 | -.07 |
| M | -5.00 | -4.00 | -4.89 | -3.95 | -3.54 | -4.83 | 4.35 | 1.45 |



| 5 | | 6 | | 7 | | 8 | |
|-------|-------|--------|-------|--------|--------|--------|-------|
| E | F | F | G | G | H | H | I |
| -2.82 | -2.82 | -2.46 | -2.28 | -2.61 | -2.43 | -2.70 | -2.49 |
| -.036 | -.028 | -.020 | -.012 | -.012 | -.007 | -.008 | -.009 |
| -.078 | | -.051 | | -.033 | | -.026 | |
| 2.58 | 2.97 | 2.16 | 2.70 | 2.40 | 2.82 | 2.76 | 2.58 |
| -2.56 | -2.16 | -2.97 | -2.40 | -2.70 | -2.76 | -2.82 | 0 |
| -.035 | -.022 | -.024 | -.012 | -.012 | -.008 | -.001 | -.007 |
| -.041 | | -.027 | | -.015 | | -.005 | |
| -.26 | .23 | -.27 | .27 | -.13 | .13 | .40 | -.40 |
| 1.04 | .27 | -.28 | .13 | -.27 | -.40 | -.13 | 0 |
| .0121 | .0042 | -.0020 | .0004 | -.0013 | -.0011 | -.0003 | 0 |
| .0122 | | -.0012 | | -.0018 | | 0 | |
| .19 | -.19 | -.05 | .05 | 0 | 0 | 0 | 0 |
| 2.49 | 3.06 | 1.84 | 3.02 | 2.27 | 2.95 | 3.16 | 2.18 |



Influence Lines First Correction Load at E

Panel 1, 8

$$299A - 37B = 0$$

$$-52A + 100B = 3.76$$

$$A = .0012$$

$$B = .0095$$

$$R_1 = .0079$$

$$M_{AB} = 200(.0012 + \frac{1}{2} \times .0095 - .0079) = -.40$$

$$M_{BA} = 200(.0095 + \frac{1}{2} \times .0012 - .0079) = .40$$

Panel 2, 7

$$389B - 25C = -.21$$

$$-34B + 238C = 3.60$$

$$B = .0105$$

$$C = .0172$$

$$R_2 = .208$$

$$M_{EC} = 134(.0105 + \frac{1}{2} \times .0172 - .0208) = -.21$$

$$M_{CE} = 134(.0172 + \frac{1}{2} \times .0105 - .0208) = .21$$

Panel 3, 6

$$231C - 17D = 3.20$$

$$-23C + 134D = 3.96$$

$$C = .0162$$

$$D = .0324$$

$$R_3 = .0364$$

$$M_{CD} = 90(.0162 + \frac{1}{2} \times .0324 - .0362) = -.36$$

$$M_{DC} = 90(.0324 + \frac{1}{2} \times .0162 - .0362) = .36$$

Panel 4, 5

$$135D - 24E = 2.88$$

$$-24D + 94E = -3.44$$

$$D = .0155$$

$$E = -.0326$$

$$R_4 = -.0128$$

$$M_{DE} = 95(.0155 - \frac{1}{2} \times .0326 + .0128) = 1.14$$

$$M_{ED} = 95(-.0326 - \frac{1}{2} \times .0155 + .0128) = -1.14$$

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Influence Lines - Second Correction - Load at E

Panel 1,8

$$299A - 37B = 0$$

$$-52A + 400B = .21$$

$$A = .00007$$

$$B = .00053$$

$$R_1 = .00044$$

$$M_{AB} = 200(.00007 + \frac{1}{2}x.00053 - .00044) = -.02$$

$$M_{BA} = 200(.00053 + \frac{1}{2}x.00007 - .00044) = .02$$

Panel 2,7

$$389B - 25C = -.40$$

$$-34B + 238C = .36$$

$$B = -.00094$$

$$C = .00132$$

$$R_2 = .00027$$

$$M_{BC} = 134(-.00094 + \frac{1}{2}x.00132 - .00027) = -.08$$

$$M_{CB} = 134(.00132 - \frac{1}{2}x.00094 - .00027) = .08$$

Panel 3,6

$$231C - 17D = -.21$$

$$-23C + 134D = -1.14$$

$$C = -.0016$$

$$D = -.0088$$

$$R_3 = -.0077$$

$$M_{CD} = 90(-.0016 - \frac{1}{2}x.0088 + .0077) = .16$$

$$M_{DC} = 90(-.0088 - \frac{1}{2}x.0016 + .0077) = -.16$$

Panel 4,5

$$135D - 24E = -.21$$

$$-24D + 94E = 0$$

$$D = -.0016$$

$$E = -.0004$$

$$R_4 = -.0015$$

$$M_{DE} = 95(-.0016 - \frac{1}{2}x.0004 + .0015) = -.03$$

$$M_{ED} = 95(-.0004 - \frac{1}{2}x.0016 + .0015) = .03$$

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Load at PP-4

| Panel | 1 | | 2 | | 3 | | 4 | |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|
| Joint | A | B | B | C | C | D | D | E |
| -Q | 3.32 | 3.59 | 3.22 | 3.49 | 3.04 | 3.30 | 3.75 | 3.75 |
| α | .012 | .011 | .009 | .016 | .015 | .017 | .036 | .049 |
| R | .035 | | .045 | | .069 | | .10 | |
| M | -3.44 | -3.68 | -3.76 | -3.20 | -3.60 | -2.88 | -3.96 | -3.44 |
| -Q | 0 | 3.76 | 3.68 | 3.60 | 3.20 | 3.96 | 2.88 | -3.44 |
| α | .0012 | .0095 | .0105 | .0172 | .0162 | .0324 | .0155 | -.0326 |
| R | .0079 | | .0208 | | .0364 | | -.0128 | |
| M | -.40 | .40 | -.21 | .21 | -.36 | .36 | 1.14 | -1.14 |
| -Q | 0 | .21 | -.40 | .36 | -.21 | -1.14 | -.36 | -1.14 |
| α | .00007 | .00053 | .00049 | .00132 | -.0016 | -.0088 | -.0016 | -.0004 |
| R | .00044 | | .00027 | | -.0077 | | -.0015 | |
| M | -.02 | .02 | -.08 | .08 | .16 | -.16 | -.03 | .03 |
| M | -3.86 | -3.26 | -4.05 | -2.91 | -3.80 | -2.68 | -2.85 | -4.55 |

| Year | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | 2007 | | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | | 2014 | | 2015 | | 2016 | | 2017 | | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | | 2023 | | 2024 | | 2025 | | 2026 | | 2027 | | 2028 | | 2029 | | 2030 | | 2031 | | 2032 | | 2033 | | 2034 | | 2035 | | 2036 | | 2037 | | 2038 | | 2039 | | 2040 | | 2041 | | 2042 | | 2043 | | 2044 | | 2045 | | 2046 | | 2047 | | 2048 | | 2049 | | 2050 | | 2051 | | 2052 | | 2053 | | 2054 | | 2055 | | 2056 | | 2057 | | 2058 | | 2059 | | 2060 | | 2061 | | 2062 | | 2063 | | 2064 | | 2065 | | 2066 | | 2067 | | 2068 | | 2069 | | 2070 | | 2071 | | 2072 | | 2073 | | 2074 | | 2075 | | 2076 | | 2077 | | 2078 | | 2079 | | 2080 | | 2081 | | 2082 | | 2083 | | 2084 | | 2085 | | 2086 | | 2087 | | 2088 | | 2089 | | 2090 | | 2091 | | 2092 | | 2093 | | 2094 | | 2095 | | 2096 | | 2097 | | 2098 | | 2099 | | 2100 | | 2101 | | 2102 | | 2103 | | 2104 | | 2105 | | 2106 | | 2107 | | 2108 | | 2109 | | 2110 | | 2111 | | 2112 | | 2113 | | 2114 | | 2115 | | 2116 | | 2117 | | 2118 | | 2119 | | 2120 | | 2121 | | 2122 | | 2123 | | 2124 | | 2125 | | 2126 | | 2127 | | 2128 | | 2129 | | 2130 | | 2131 | | 2132 | | 2133 | | 2134 | | 2135 | | 2136 | | 2137 | | 2138 | | 2139 | | 2140 | | 2141 | | 2142 | | 2143 | | 2144 | | 2145 | | 2146 | | 2147 | | 2148 | | 2149 | | 2150 | | 2151 | | 2152 | | 2153 | | 2154 | | 2155 | | 2156 | | 2157 | | 2158 | | 2159 | | 2160 | | 2161 | | 2162 | | 2163 | | 2164 | | 2165 | | 2166 | | 2167 | | 2168 | | 2169 | | 2170 | | 2171 | | 2172 | | 2173 | | 2174 | | 2175 | | 2176 | | 2177 | | 2178 | | 2179 | | 2180 | | 2181 | | 2182 | | 2183 | | 2184 | | 2185 | | 2186 | | 2187 | | 2188 | | 2189 | | 2190 | | 2191 | | 2192 | | 2193 | | 2194 | | 2195 | | 2196 | | 2197 | | 2198 | | 2199 | | 2200 | | 2201 | | 2202 | | 2203 | | 2204 | | 2205 | | 2206 | | 2207 | | 2208 | | 2209 | | 2210 | | 2211 | | 2212 | | 2213 | | 2214 | | 2215 | | 2216 | | 2217 | | 2218 | | 2219 | | 2220 | | 2221 | | 2222 | | 2223 | | 2224 | | 2225 | | 2226 | | 2227 | | 2228 | | 2229 | | 2230 | | 2231 | | 2232 | | 2233 | | 2234 | | 2235 | | 2236 | | 2237 | | 2238 | | 2239 | | 2240 | | 2241 | | 2242 | | 2243 | | 2244 | | 2245 | | 2246 | | 2247 | | 2248 | | 2249 | | 2250 | | 2251 | | 2252 | | 2253 | | 2254 | | 2255 | | 2256 | | 2257 | | 2258 | | 2259 | | 2260 | | 2261 | | 2262 | | 2263 | | 2264 | | 2265 | | 2266 | | 2267 | | 2268 | | 2269 | | 2270 | | 2271 | | 2272 | | 2273 | | 2274 | | 2275 | | 2276 | | 2277 | | 2278 | | 2279 | | 2280 | | 2281 | | 2282 | | 2283 | | 2284 | | 2285 | | 2286 | | 2287 | | 2288 | | 2289 | | 2290 | | 2291 | | 2292 | | 2293 | | 2294 | | 2295 | | 2296 | | 2297 | | 2298 | | 2299 | | 2300 | | 2301 | | 2302 | | 2303 | | 2304 | | 2305 | | 2306 | | 2307 | | 2308 | | 2309 | | 2310 | | 2311 | | 2312 | | 2313 | | 2314 | | 2315 | | 2316 | | 2317 | | 2318 | | 2319 | | 2320 | | 2321 | | 2322 | | 2323 | | 2324 | | 2325 | | 2326 | | 2327 | | 2328 | | 2329 | | 2330 | | 2331 | | 2332 | | 2333 | | 2334 | | 2335 | | 2336 | | 2337 | | 2338 | | 2339 | | 2340 | | 2341 | | 2342 | | 2343 | | 2344 | | 2345 | | 2346 | | 2347 | | 2348 | | 2349 | | 2350 | | 2351 | | 2352 | | 2353 | | 2354 | | 2355 | | 2356 | | 2357 | | 2358 | | 2359 | | 2360 | | 2361 | | 2362 | | 2363 | | 2364 | | 2365 | | 2366 | | 2367 | | 2368 | | 2369 | | 2370 | | 2371 | | 2372 | | 2373 | | 2374 | | 2375 | | 2376 | | 2377 | | 2378 | | 2379 | | 2380 | | 2381 | | 2382 | | 2383 | | 2384 | | 2385 | | 2386 | | 2387 | | 2388 | | 2389 | | 2390 | | 2391 | | 2392 | | 2393 | | 2394 | | 2395 | | 2396 | | 2397 | | 2398 | | 2399 | | 2400 | | 2401 | | 2402 | | 2403 | | 2404 | | 2405 | | 2406 | | 2407 | | 2408 | | 2409 | | 2410 | | 2411 | | 2412 | | 2413 | | 2414 | | 2415 | | 2416 | | 2417 | | 2418 | | 2419 | | 2420 | | 2421 | | 2422 | | 2423 | | 2424 | | 2425 | | 2426 | | 2427 | | 2428 | | 2429 | | 2430 | | 2431 | | 2432 | | 2433 | | 2434 | | 2435 | | 2436 | | 2437 | | 2438 | | 2439 | | 2440 | | 2441 | | 2442 | | 2443 | | 2444 | |
|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|------|--|
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| 5 | | 6 | | 7 | | 8 | |
|-------|--------|--------|--------|---------|--------|---------|---------|
| F | F | F | G | G | H | H | I |
| -5.73 | -3.78 | -3.28 | -3.04 | -3.48 | -3.24 | -3.60 | -3.32 |
| .049 | -.036 | -.027 | -.015 | -.016 | -.009 | -.011 | -.012 |
| .10 | | -.069 | | -.045 | | -.035 | |
| 3.44 | 3.96 | 2.88 | 3.60 | 3.20 | 3.76 | 3.68 | 3.44 |
| 3.44 | -2.88 | -3.96 | -3.20 | -3.60 | -3.68 | -3.76 | 0 |
| .0326 | -.0155 | -.0324 | -.0162 | -.0172 | -.0105 | -.0095 | -.0012 |
| .0128 | | -.0364 | | -.0208 | | -.0079 | |
| 1.14 | -1.14 | -.36 | .36 | -.21 | .21 | -.40 | .40 |
| 1.14 | .36 | 1.14 | .21 | -.36 | .40 | -.21 | 0 |
| .0004 | .0016 | .0088 | .0016 | -.00132 | .00094 | -.00053 | -.00007 |
| .0015 | | .0077 | | -.00027 | | -.00044 | |
| -.03 | .03 | .16 | -.16 | -.08 | .08 | -.02 | .02 |
| 4.55 | 2.85 | 2.68 | 3.80 | 2.91 | 4.05 | 3.26 | 3.86 |

Moment Computations - Web Members

Member AA'

$$Dh = 3140 \text{ fk}$$

$$hh \text{ E-60} = 2755$$

$$\text{Impact} = \underline{590}$$

$$\text{Total} = 6485$$

$$hh \text{ H-15-S12-44} = 367$$

$$\text{Conc.} = 86$$

$$\text{Impact} = \underline{62}$$

$$\text{Total} = 515$$

$$\text{Sidewalk} = 222$$

$$\text{Design Moment} = 11,762 \text{ fk}$$

Member BB'

$$Dh = 5180 \text{ fk}$$

$$hh \text{ E-60} = 4423$$

$$\text{Impact} = \underline{947}$$

$$\text{Total} = 10,550$$

$$hh \text{ H15-S12-44} = 606$$

$$\text{Conc.} = 142$$

$$\text{Impact} = \underline{102}$$

$$\text{Total} = 850$$

$$\text{Sidewalk} = 362$$

$$\text{Design Moment} = 11,762 \text{ fk}$$

Member CC'

$$Dh = 3258 \text{ fk}$$

$$hh \text{ E-60} = 2882$$

$$\text{Impact} = \underline{626}$$

$$\text{Total} = 6766$$

$$hh \text{ H15-S12-44} = 381$$

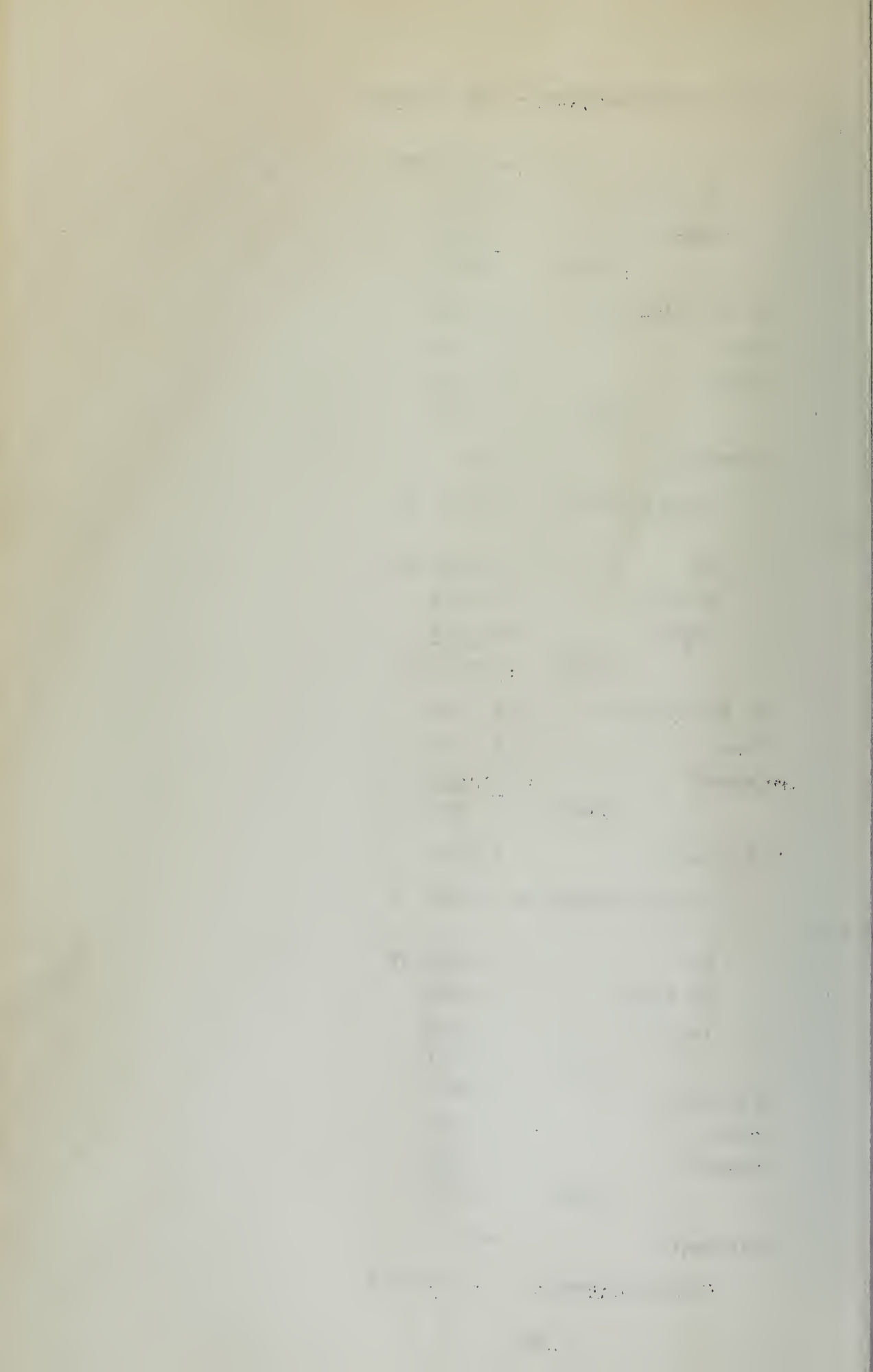
$$\text{Conc.} = 109$$

$$\text{Impact} = \underline{77}$$

$$\text{Total} = 567$$

$$\text{Sidewalk} = 242$$

$$\text{Design Moment} = 7,575 \text{ fk}$$



Member DE

| | | |
|---------------|---|------------|
| Dh | = | 1830 |
| hh-E-60 | = | 1652 |
| Impact | = | <u>436</u> |
| Total | | 3948 |
| hr H15-S12-44 | = | 215 |
| Conc. | = | 79 |
| Impact | = | <u>53</u> |
| Total | | 347 |
| Sidewalk | = | 152 |
| Design Moment | = | 4,447 |

Member EE'

| | | |
|---------------|---|------------|
| Dh | = | 1156 fk |
| hh-E-60 | = | 1110 |
| Impact | = | <u>389</u> |
| Total | | 2655 |
| hr h15-S12-44 | = | 135 |
| Conc. | = | 64 |
| Impact | = | <u>42</u> |
| Total | | 241 |
| Sidewalk | = | 104 |
| Design Moment | = | 3000 fk |

Moment Computations - Chord Members

Member AB

| | | | |
|---------------|---|------------|----|
| DL | = | 3140 | fk |
| LL-E60 | = | 2755 | |
| Impact | = | <u>590</u> | |
| Total | | 6485 | |
| LL HL5-SL2-44 | = | 367 | |
| Conc. | = | 86 | |
| Impact | = | <u>62</u> | |
| Total | | 515 | |
| Sidewalk | = | 222 | |
| Design Moment | = | 7,222 | |

Member BC

| | | | |
|---------------|---|------------|----|
| DL | = | 2330 | fk |
| LL-E60 | = | 2128 | |
| Impact | = | <u>454</u> | |
| Total | | 4912 | |
| LL HL5-SL2-44 | = | 273 | |
| Conc. | = | 80 | |
| Impact | = | <u>55</u> | |
| Total | | 408 | |
| Sidewalk | = | 172 | |
| Design Moment | = | 5,492 | fk |

Member CD

| | | | |
|---------------|---|------------|----|
| DL | = | 1525 | fk |
| LL-E60 | = | 1382 | |
| Impact | = | <u>321</u> | |
| Total | = | 3128 | |
| LL H15-S12-44 | = | 179 | |
| Conc. | = | 61 | |
| Impact | = | <u>41</u> | |
| Total | = | 281 | |
| Sidewalk | = | 120 | |
| Design Moment | = | 3,529 | fk |

Member DE

| | | | |
|---------------|---|------------|----|
| DL | = | 1135 | fk |
| LL-E60 | = | 1088 | |
| Impact | = | <u>327</u> | |
| Total | = | 2550 | |
| LL H15-S12-44 | = | 133 | |
| Conc. | = | 62 | |
| Impact | = | <u>37</u> | |
| Total | = | 232 | |
| Sidewalk | = | 95 | |
| Design Moment | = | 2,877 | fk |

Influence Line Computations.

Load at B

Panel #1

$$-Q_A = \frac{(.0942 - 1)(.0866 \times 26.25 - .875 \times 30)}{2(2 - .0866)1} = 5.77$$

$$-Q_B = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)} = 6.28$$

$$Q_{R1} = \frac{.875 \times 30 - .0866 \times 26.25}{2(2 - .0866)1} = 6.28$$

Panel #2

$$-Q_B = \frac{(.0463 - 1)(.0443 \times 22.5 + .125 \times 30)}{2(2 - .0443)} = -1.15$$

$$-Q_C = \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)} = -1.21$$

$$Q_{R2} = \frac{-.125 \times 30 - .0443 \times 22.5}{2(2 - .0443)1} = -1.21$$

Panel #3

$$-Q_C = \frac{(.0507 - 1)(.0482 \times 18.75 + .125 \times 30)}{2(2 - .0482)1} = -1.13$$

$$-Q_D = \frac{-.125 \times 30 - .0482 \times 18.75}{2(2 - .0482)} = -1.19$$

$$Q_{R3} = \frac{-.125 \times 30 - .0482 \times 18.75}{2(2 - .0482)1} = -1.19$$

Panel #4

$$-Q_D = \frac{-1(.125 \times 30)}{4} = -.94$$

$$-Q_E = \frac{-.125 \times 30}{4} = -.94$$

$$Q_{R4} = \frac{-.125 \times 30}{4} = -.94$$

...the
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... ..

1. The first group of people who are interested in the study of the history of the United States are the people who are interested in the history of the United States.

[illegible]

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100

100

Panel 5

$$-Q_E = \frac{-.125 \times 30}{4} = -0.94$$

$$-Q_F = \frac{-.125 \times 30}{4} = -0.94$$

$$Q_{R5} = \frac{-.125 \times 30}{4 \times 1} = -0.94$$

Panel 6

$$-Q_G = \frac{(.0507 \times 1 - 1)(-.0482 \times 11.25 + .125 \times 30)}{2(2 - .0482)1} = -0.78$$

$$-Q_F = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)} = -0.82$$

$$Q_{R6} = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)1} = -0.82$$

Panel 7

$$-Q_H = \frac{(.0463 \times 1 - 1)(-.0443 \times 7.5 + .125 \times 30)}{2(2 - .0443)1} = -0.83$$

$$-Q_G = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)} = -0.87$$

$$Q_{R7} = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)1} = -0.87$$

Panel 8

$$-Q_I = \frac{(.0942 \times 1 - 1)(-.0866 \times 3.75 + .125 \times 30)}{2(2 - .0866)1} = -0.81$$

$$-Q_H = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)} = -0.90$$

$$Q_{R8} = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)} = -0.90$$

Load at C

Panel 1

$$-Q_A = \frac{(.0942 - 1)(.0866 \times 22.5 - .75 \times 30)}{2(2 - .0866)1} = 4.89$$

$$-Q_B = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R1} = \frac{.75 \times 30 - .0866 \times 22.5}{2(2 - .0866)1} = 5.38$$

Panel 2

$$-Q_B = \frac{(.0463 - 1)(.0443 \times 45 - .75 \times 30)}{2(2 - .0443)1} = 4.96$$

$$-Q_C = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)} = 5.23$$

$$Q_{R2} = \frac{.75 \times 30 - .0443 \times 45}{2(2 - .0443)1} = 5.23$$

Panel 3

$$-Q_C = \frac{(.0507 - 1)(.0482 \times 37.5 + .25 \times 30)}{2(2 - .0482)1} = -2.36$$

$$-Q_D = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)} = -2.38$$

$$Q_{R3} = \frac{-.25 \times 30 - .0482 \times 37.5}{2(2 - .0482)1} = -2.38$$

Panel 4

$$-Q_D = \frac{-1(.25 \times 30)}{4} = -1.87$$

$$-Q_E = \frac{-.25 \times 30}{4} = -1.87$$

$$Q_{R4} = \frac{-.25 \times 30}{4} = -1.87$$

1890

1891

1892

1893

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1896

1897

1898

1899

1900

1901

Panel 5

$$-Q_E = -1.88$$

$$-Q_F = -1.88$$

$$Q_{R5} = -1.88$$

Panel 6

$$-Q_E = -1.64$$

$$-Q_G = -1.56$$

$$Q_{R6} = -1.64$$

Panel 7

$$-Q_G = -1.74$$

$$-Q_H = -1.66$$

$$Q_{R7} = -1.74$$

Panel 8

$$-Q_H = -1.80$$

$$-Q_I = -1.62$$

$$Q_{R8} = -1.80$$

11-15

11-16

11-17

11-18

11-19

11-20

11-21

11-22

11-23

11-24

11-25

Load at D

Panel 1

$$-Q_A = \frac{(.0942 - 1)(.0866 \times 18.75 - .625 \times 30)}{2(2 - .0866)1} = 4.12$$

$$-Q_B = \frac{.625 \times 30 - .0866 \times 18.75}{2(2 - .0866)} = 4.49$$

$$Q_{R1} = \frac{.625 \times 30 - .0866 \times 18.75}{2(2 - .0866)1} = 4.49$$

Panel 2

$$-Q_B = \frac{(.0463 - 1)(.0443 \times 37.5 - .625 \times 30)}{2(2 - .0443)1} = 4.14$$

$$-Q_C = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)} = 4.36$$

$$Q_{R2} = \frac{.625 \times 30 - .0443 \times 37.5}{2(2 - .0443)1} = 4.36$$

Panel 3

$$-Q_C = \frac{(.0507 - 1)(.0482 \times 56.25 - .625 \times 30)}{2(2 - .0482)1} = 3.91$$

$$-Q_D = \frac{.625 \times 30 - .0482 \times 56.25}{2(2 - .0482)} = 4.12$$

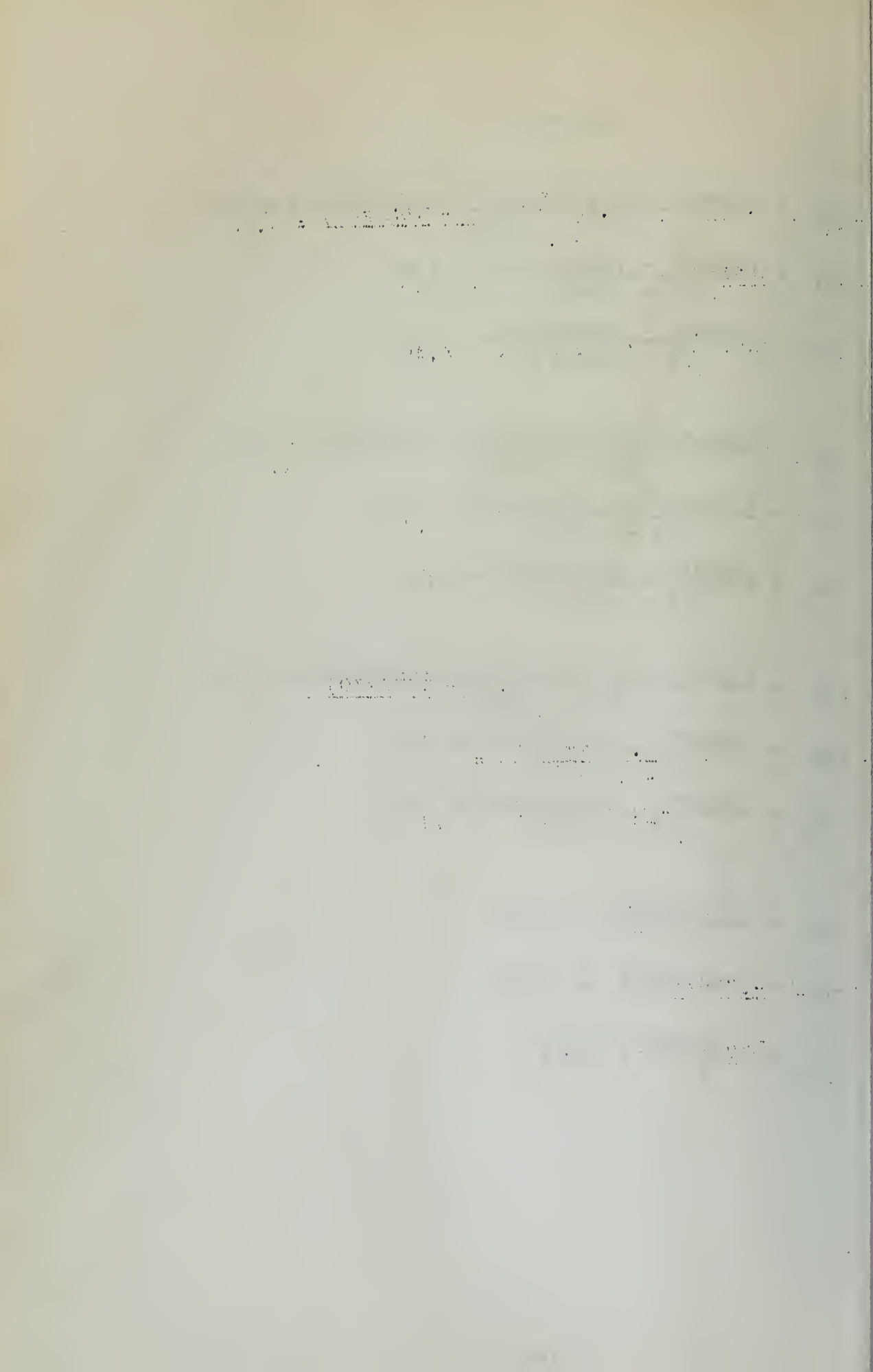
$$Q_{R3} = \frac{.625 \times 30 - .0482 \times 56.25}{2(2 - .0482)} = 4.12$$

Panel 4

$$-Q_D = \frac{-1(.375 \times 30)}{4} = -2.82$$

$$-Q_E = \frac{(-.375 \times 30)}{4} = -2.82$$

$$Q_{R4} = \frac{-.375 \times 30}{4} = -2.82$$



Panel 5

$$-Q_E = -2.82$$

$$-Q_F = -2.82$$

$$Q_{R5} = -2.82$$

Panel 6

$$-Q_F = -2.46$$

$$-Q_G = -2.34$$

$$Q_{R6} = -2.46$$

Panel 7

$$-Q_G = -2.61$$

$$-Q_H = -2.49$$

$$Q_{R7} = -2.61$$

Panel 8

$$-Q_H = -2.70$$

$$-Q_I = -2.43$$

$$Q_{R8} = -2.70$$



Load at E

Panel 1

$$-Q_A = \frac{(.0942 - 1)(.0866 \times 15 - .5 \times 30)}{2(2 - .0866)1} = 3.26$$

$$-Q_B = \frac{.5 \times 30 - .0866 \times 15}{2(2 - .0866)} = 3.59$$

$$Q_{R1} = \frac{.5 \times 30 - .0866 \times 15}{2(2 - .0866)1} = 3.59$$

Panel 2

$$-Q_B = \frac{(.0463 - 1)(.0443 \times 30 - .5 \times 30)}{2(2 - .0443)1} = 3.31$$

$$-Q_C = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)} = 3.49$$

$$Q_{R2} = \frac{.5 \times 30 - .0443 \times 30}{2(2 - .0443)1} = 3.49$$

Panel 3

$$-Q_C = \frac{(.0507 - 1)(.0482 \times 45 - .5 \times 30)}{2(2 - .0482)1} = 3.13$$

$$-Q_D = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)} = 3.30$$

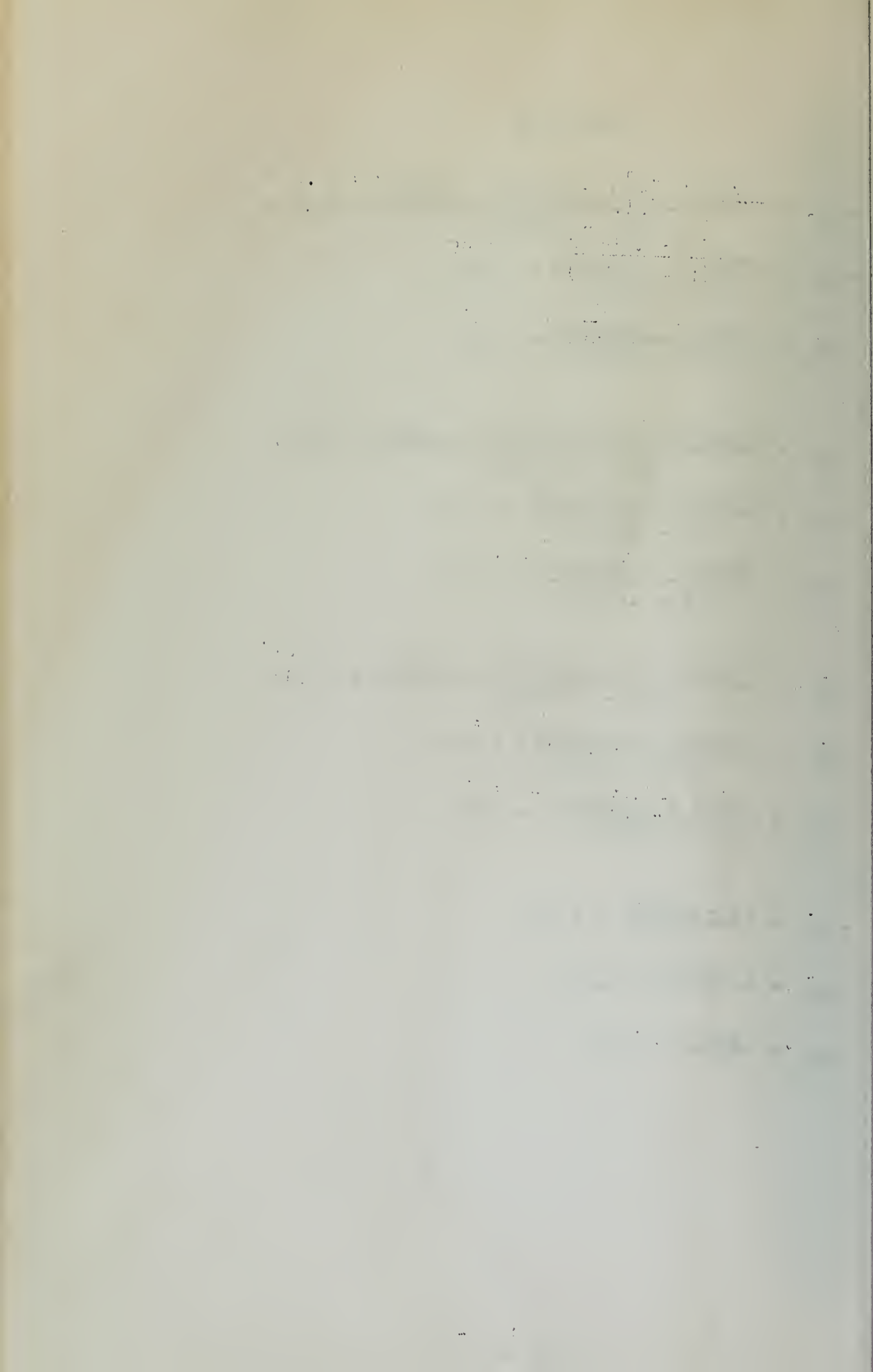
$$Q_{R3} = \frac{.5 \times 30 - .0482 \times 45}{2(2 - .0482)1} = 3.30$$

Panel 4

$$-Q_D = \frac{-1(-.5 \times 30)}{4} = 3.75$$

$$-Q_E = \frac{(.5 \times 30)}{4} = 3.75$$

$$Q_{R4} = \frac{.5 \times 30}{4} = 3.75$$



Panel 5

$$-Q_E = -3.76$$

$$-Q_F = -3.76$$

$$Q_{R5} = -3.76$$

Panel 6

$$-Q_E = -3.28$$

$$-Q_G = -3.12$$

$$Q_{R6} = -3.28$$

Panel 7

$$-Q_G = -3.48$$

$$-Q_H = -3.32$$

$$Q_{R7} = -3.48$$

Panel 8

$$-Q_H = -3.60$$

$$-Q_I = -3.24$$

$$Q_{R8} = -3.60$$

Equations for Determining Joint Constants

Panel 1

$$\left[1.5x1 + 1 + \frac{(3 - .0866)(.0942x1 - 1)}{2(2 - .0866)} \right] A + \left[\frac{1}{2} + \frac{(3 - 2x.0866)(.0942x1 - 1)}{2(2 - .0866)} \right] B = -Q_A$$

$$1.82A - .17B = -Q_A$$

$$\left[1 + 1.5x1 - \frac{(3 - 2x.0866)1}{2(2 - .0866)} \right] B + \left[\frac{1}{2} - \frac{(3 - .0866)1}{2(2 - .0866)} \right] A = -Q_B$$

$$1.76B - .26A = -Q_B$$

Panel 2

$$\left[1.5x1 + 1 + \frac{(3 - .0443)(.0463x1 - 1)}{2(2 - .0443)} \right] B + \left[\frac{1}{2} + \frac{(3 - 2x.0443)(.0463x1 - 1)}{2(2 - .0443)} \right] C = -Q_B$$

$$1.78B - .21C = -Q_B$$

$$\left[1 + 1.5x1 - \frac{(3 - 2x.0443)1}{2(2 - .0443)} \right] C + \left[\frac{1}{2} + \frac{(3 - .0443)1}{2(2 - .0443)} \right] B = -Q_C$$

$$1.76C - .26B = -Q_C$$

• • •

Panel 3

$$\left[1.5x1 + 1 + \frac{(3 - .0482)(.0507x1 - 1)}{2(2 - .0482)} \right] C + \left[\frac{1}{2} + \frac{(3 - 2x.0482)(.0507x1 - 1)}{2(2 - .0482)} \right] D = -Q_C$$

$$1.78C - .21D = -Q_C$$

$$\left[1 + 1.5x1 - \frac{(3 - 2x.0482)x1}{2(2 - .0482)} \right] D + \left[\frac{1}{2} - \frac{(3 - .0482)x1}{2(2 - .0482)} \right] C = -Q_D$$

$$1.76D - .26C = -Q_D$$

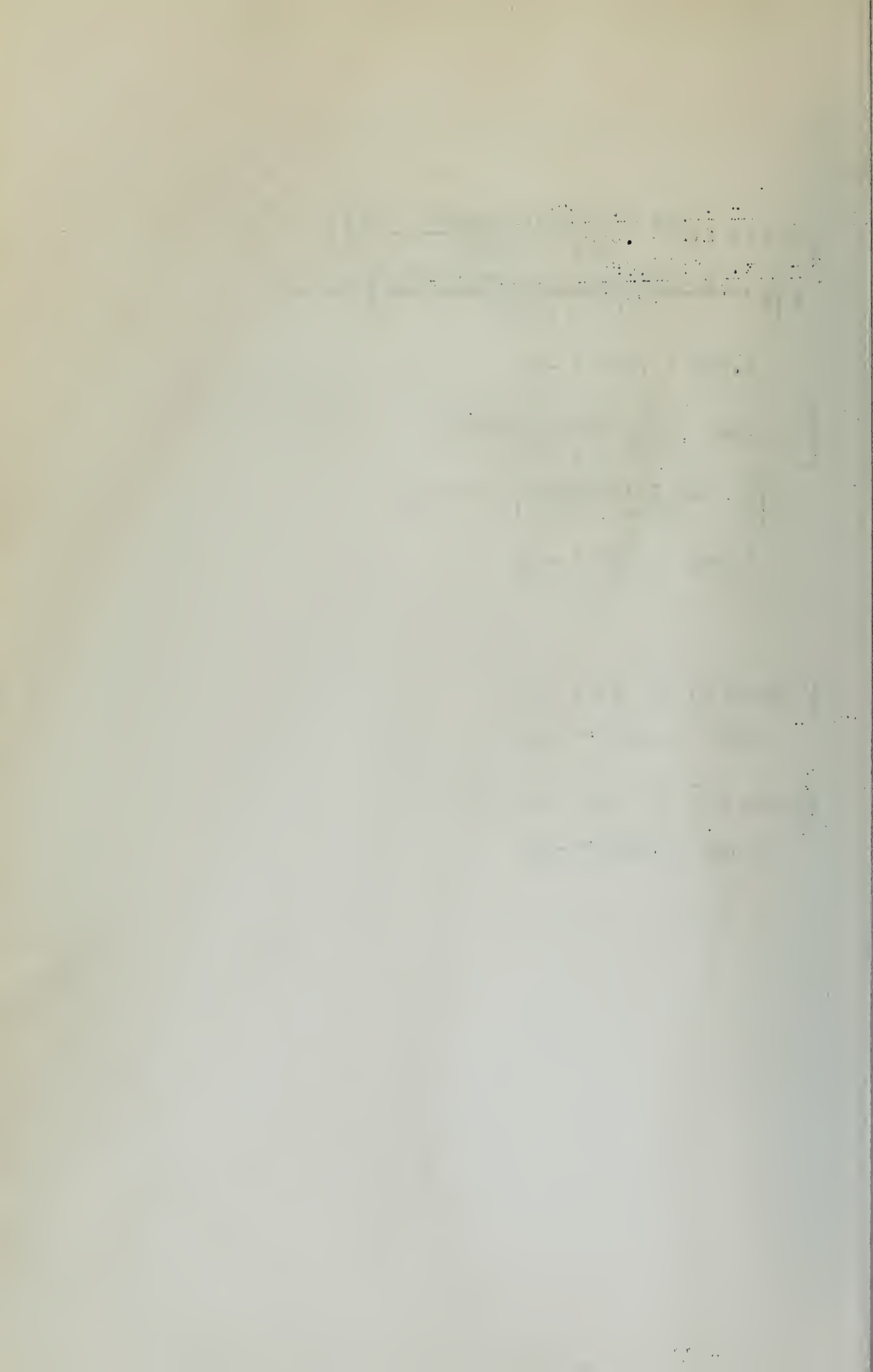
Panel 4

$$\left[1.5x1 + \frac{1}{4} \right] D - \frac{1}{4}E = -Q_D$$

$$1.75D - .25E = -Q_D$$

$$\left[1.5x1 + \frac{1}{4} \right] E - \frac{1}{4}D = -Q_E$$

$$1.75E - .25D = -Q_E$$



Joint Constant Computation - Load at B

Panel 1

$$1.82A - .17B = 5.77$$

$$-.26A + 1.76B = 6.28$$

$$A = 3.56 \quad B = 4.09$$

$$R_1 = \frac{2.91 \times 3.56 + 2.83 \times 4.09}{3.82} + 6.28 = 12.03$$

$$M_{FL} = (3.56 + \frac{4.09}{2} - 12.03) = -6.43$$

$$M_{BA} = (4.09 + \frac{3.56}{2} - 12.03) = -6.16$$

Panel 2

$$1.78B - .21C = -1.15$$

$$-.26B + 1.76C = -1.21$$

$$B = -.74 \quad C = -.80$$

$$R_2 = \frac{-2.96 \times .74 - 2.91 \times .80}{3.92} - 1.21 = -2.36$$

$$M_{BC} = (-.74 - \frac{.80}{2} + 2.36) = 1.22$$

$$M_{CB} = (-.80 - \frac{.74}{2} + 2.36) = 1.19$$

Panel 3

$$1.78C - .21D = -1.13$$

$$-.26C + 1.76D = -1.19$$

$$C = -.73 \quad D = -.78$$

$$R_3 = \frac{-2.95 \times .73 - 2.90 \times .78}{3.90} - 1.19 = -2.33$$

$$M_{CD} = (-.73 - \frac{.78}{2} + 2.33) = 1.21$$

$$M_{DC} = (-.78 - \frac{.73}{2} + 2.33) = 1.19$$

Panel 4

$$1.75D - .25E = -.94$$

$$-.25D + 1.75E = -.94$$

$$D = -.63 \quad E = -.63$$

$$R_4 = \frac{3}{4}(-.63 - .63) - .94 = -1.88$$

$$M_{DE} = (-.63 - \frac{.63}{2} + 1.88) = .94$$

$$M_{ED} = (-.63 - \frac{.63}{2} + 1.88) = .94$$

Panel 5

$$1.75E - .25F = -0.94$$

$$-.25E + 1.75F = -0.94$$

$$E = -0.63 \quad F = -0.63$$

$$R_5 = 3/4(-0.63 - 0.63) - 0.94 = -1.88$$

$$M_{EF} = 1(-0.63 - \frac{1}{2} \times 0.63 + 1.88) = .94$$

$$M_{FE} = 1(-0.63 - \frac{1}{2} \times 0.63 + 1.88) = .94$$

Panel 6

$$1.76F - .26G = -0.82$$

$$-.21F + 1.78G = -0.78$$

$$F = -0.54 \quad G = -0.50$$

$$R_6 = \frac{-2.90 \times .54 - 2.95 \times .50}{3.90} - .82 = -1.60$$

$$M_{FG} = 1(-0.54 - \frac{1}{2} \times 0.50 + 1.60) = 0.81$$

$$M_{GF} = 1(-0.50 - \frac{1}{2} \times 0.54 + 1.60) = 0.83$$

Panel 7

$$1.76G - .26H = -0.87$$

$$-.20G + 1.78H = -0.83$$

$$G = -0.57 \quad H = -0.53$$

$$R_7 = \frac{-2.91 \times .57 - 2.96 \times 0.53}{3.91} - 0.87 = 1.70$$

$$M_{GH} = 1(-0.57 - \frac{1}{2} \times 0.53 + 1.70) = .87$$

$$M_{HG} = 1(-0.53 - \frac{1}{2} \times 0.57 + 1.70) = .89$$

Panel 8

$$1.76H - .26I = -0.90$$

$$-.17H + 1.92I = -0.81$$

$$H = -0.59 \quad I = -0.50$$

$$R_8 = \frac{-2.83 \times .59 - 2.91 \times .50}{3.83} - 0.90 = -1.71$$

$$M_{HI} = 1(-0.59 - \frac{1}{2} \times 0.50 + 1.71) = 0.87$$

$$M_{IH} = 1(-0.50 - \frac{1}{2} \times 0.59 + 1.71) = 0.93$$

London, September 18, 1891

My dear Mr. Brewster

I have just received your letter of the 17th

and am glad to hear

that you are well and hope to see you

soon.

I have been thinking of you very much lately and
wondering how you are getting on.

Yours

W. H. C.

W. H. C. Brewster

1891

1891

1891

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1891

Panel 5

$$1.75E - .25F = -0.94$$

$$-.25E + 1.75F = -0.94$$

$$E = -0.63 \quad F = -0.63$$

$$R_5 = 3/4(-0.63 - 0.63) - 0.94 = -1.88$$

$$M_{EF} = 1(-0.63 - \frac{1}{2} \times 0.63 + 1.88) = .94$$

$$M_{FE} = 1(-0.63 - \frac{1}{2} \times 0.63 + 1.88) = .94$$

Panel 6

$$1.76F - .26G = -0.82$$

$$-.21F + 1.78G = -0.78$$

$$F = -0.54 \quad G = -0.50$$

$$R_6 = \frac{-2.90 \times .54 - 2.95 \times .50}{3.90} - .82 = -1.60$$

$$M_{FG} = 1(-0.54 - \frac{1}{2} \times 0.50 + 1.60) = 0.81$$

$$M_{GF} = 1(-0.50 - \frac{1}{2} \times 0.54 + 1.60) = 0.83$$

Panel 7

$$1.76G - .26H = -0.87$$

$$-.20G + 1.78H = -0.83$$

$$G = -0.57 \quad H = -0.53$$

$$R_7 = \frac{-2.91 \times .57 - 2.96 \times 0.53}{3.91} - 0.87 = 1.70$$

$$M_{GH} = 1(-0.57 - \frac{1}{2} \times 0.53 + 1.70) = .87$$

$$M_{HG} = 1(-0.53 - \frac{1}{2} \times 0.57 + 1.70) = .89$$

Panel 8

$$1.76H - .26I = -0.90$$

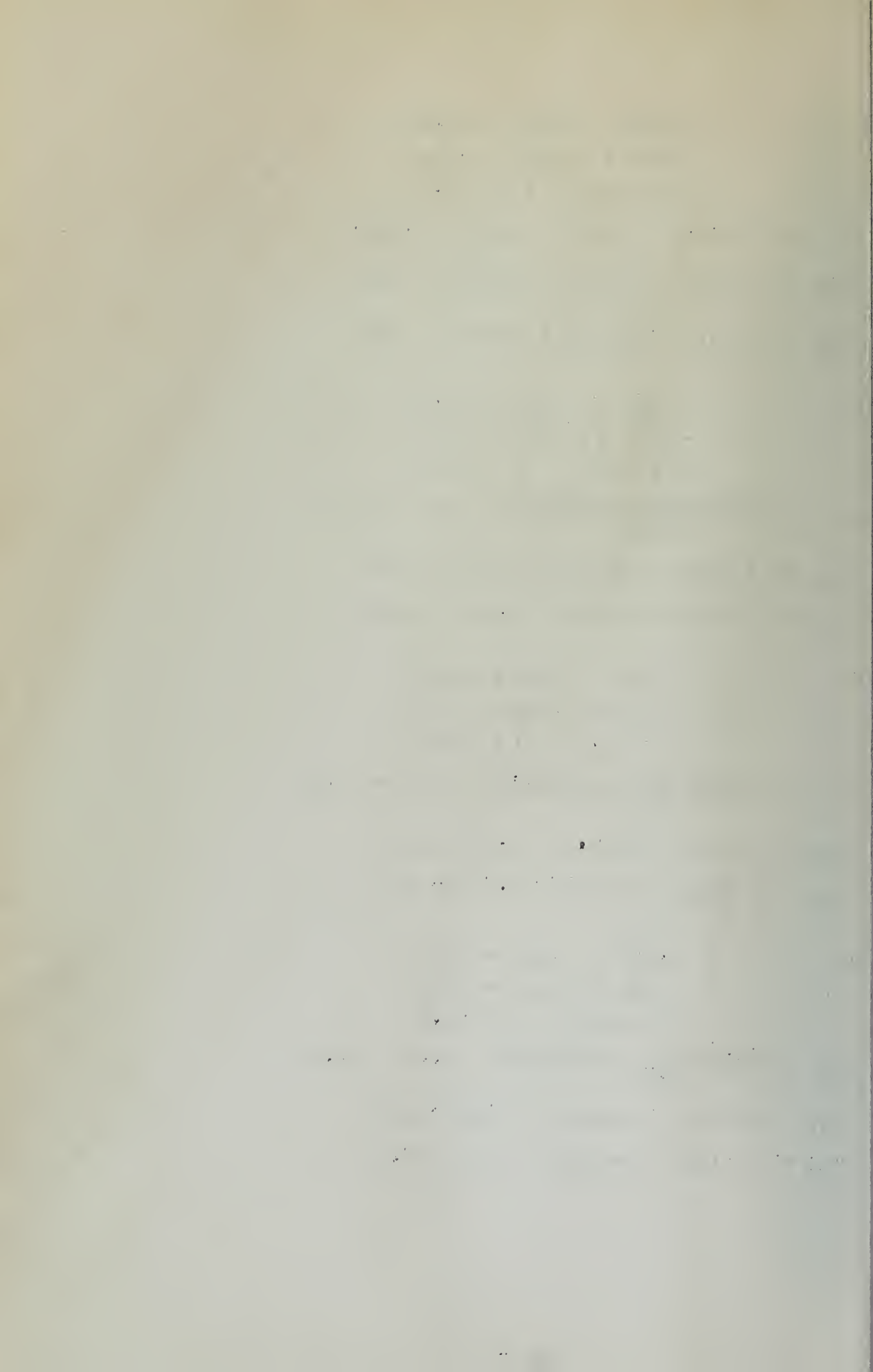
$$-.17H + 1.82I = -0.81$$

$$H = -0.59 \quad I = -0.50$$

$$R_8 = \frac{-2.83 \times .59 - 2.91 \times .50}{3.83} - 0.90 = -1.71$$

$$M_{HI} = 1(-0.59 - \frac{1}{2} \times 0.50 + 1.71) = 0.87$$

$$M_{IH} = 1(-0.50 - \frac{1}{2} \times 0.59 + 1.71) = 0.93$$



Joint Constant Computations - Load at C

Panel 1

$$1.82A - .17B = 4.89$$

$$-.26A + 1.76B = 5.38$$

$$A = 3.01 \quad B = 3.50$$

$$R_1 = \frac{2.91 \times 3.01 + 2.83 \times 3.50}{3.82} + 5.38 = 10.27$$

$$M_{AB} = (3.01 + \frac{3.50}{2} - 10.27) = -5.51$$

$$M_{BA} = (3.50 + \frac{3.01}{2} - 10.27) = -5.27$$

Panel 2

$$1.78B - .21C = 4.96$$

$$-.26B + 1.76C = 5.23$$

$$B = 3.20 \quad C = 3.44$$

$$R_2 = \frac{2.96 \times 3.20 + 2.91 \times 3.44}{3.92} + 5.23 = 10.21$$

$$M_{BC} = (3.20 + \frac{3.44}{2} - 10.21) = -5.29$$

$$M_{CB} = (3.44 + \frac{3.20}{2} - 10.21) = -5.17$$

Panel 3

$$1.78C - .21D = -2.36$$

$$-.26C + 1.76D = -2.38$$

$$C = -1.51 \quad D = -1.58$$

$$R_3 = \frac{-2.95 \times 1.51 - 2.90 \times 1.58}{3.90} - 2.38 = -4.70$$

$$M_{CD} = (-1.51 - \frac{1.58}{2} + 4.70) = 2.40$$

$$M_{DC} = (-1.58 - \frac{1.51}{2} + 4.70) = 2.37$$

Panel 4

$$1.75D - .25E = -1.87$$

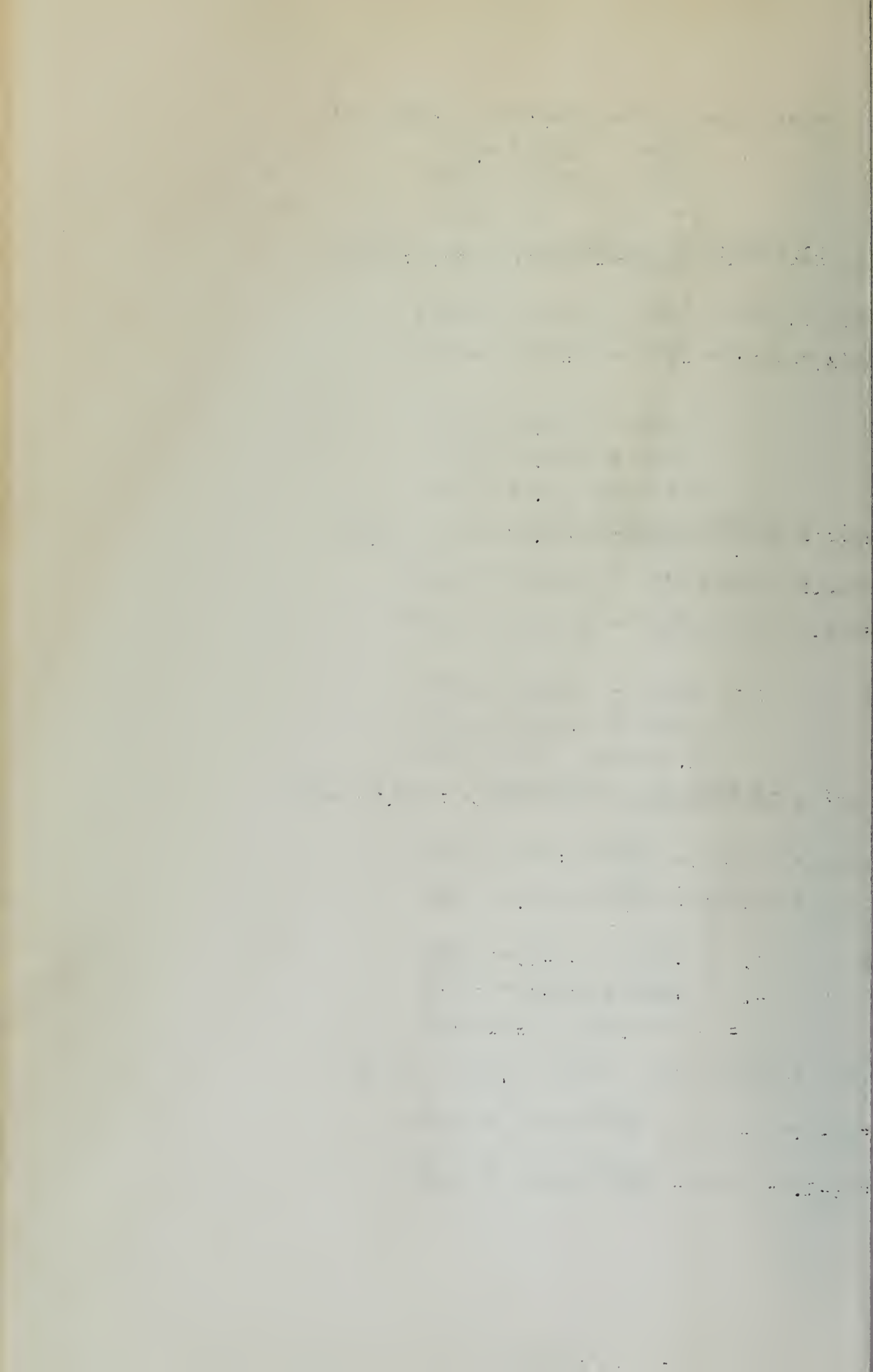
$$-.26D + 1.75E = -1.87$$

$$D = -1.25 \quad E = -1.25$$

$$R_4 = 3/4(-1.25 - 1.25) - 1.87 = -3.74$$

$$M_{DE} = (-1.25 - \frac{1.25}{2} + 3.74) = 1.87$$

$$M_{ED} = (-1.25 - \frac{1.25}{2} + 3.74) = 1.87$$



Panel 5

$$E = -1.26$$

$$F = -1.26$$

$$R_5 = -3.76$$

$$M_{EF} = 1.88$$

$$M_{FE} = 1.88$$

Panel 6

$$F = -1.08$$

$$G = -1.00$$

$$R_6 = -3.20$$

$$M_{FG} = 1.62$$

$$M_{GF} = 1.66$$

Panel 7

$$G = -1.14$$

$$H = -1.06$$

$$R_7 = -3.40$$

$$M_{GH} = 1.74$$

$$M_{HG} = 1.78$$

Panel 8

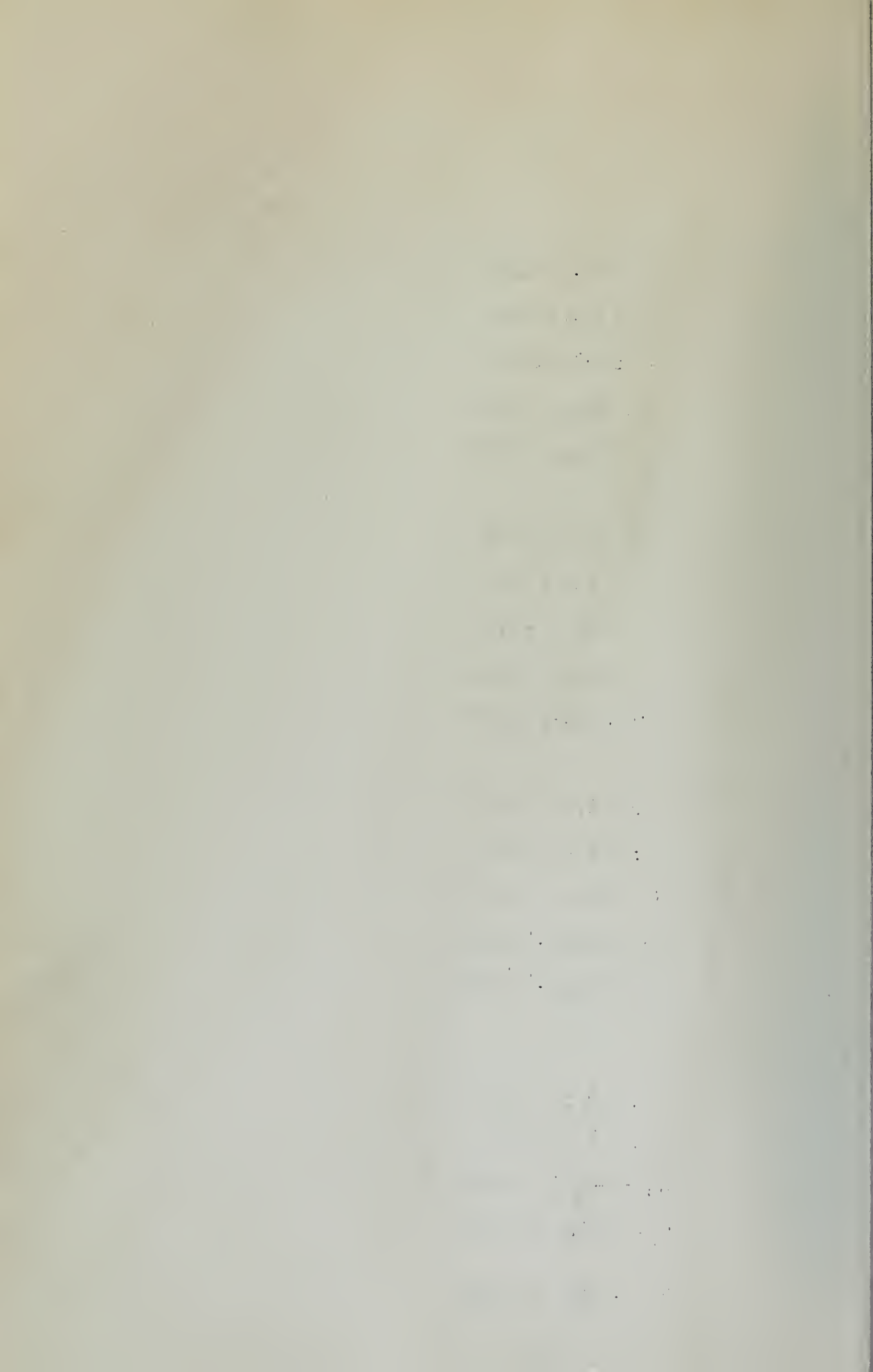
$$H = -1.18$$

$$I = -1.00$$

$$R_8 = -3.42$$

$$M_{HI} = 1.74$$

$$M_{IH} = 1.86$$



Joint Constant Computation-Load at D

Panel 1

$$\begin{aligned} 1.82A - .17B &= 4.12 \\ -.26A + 1.76B &= 4.49 \\ A &= 2.54 \quad B = 2.92 \end{aligned}$$

$$R_1 = \frac{2.91 \times 2.54 + 2.83 \times 2.92 + 4.49}{3.82} = 8.59$$

$$M_{AB} = (2.54 + \frac{2.92}{2} - 8.59) = -4.59$$

$$M_{BA} = (2.92 + \frac{2.54}{2} - 8.59) = -4.50$$

Panel 2

$$\begin{aligned} 1.78B - .21C &= 4.14 \\ -.26B + 1.76C &= 4.36 \end{aligned}$$

$$B = 2.67 \quad C = 2.87$$

$$R_2 = \frac{2.96 \times 2.67 + 2.91 \times 2.87 + 4.36}{3.92} = 8.51$$

$$M_{BC} = (2.67 + \frac{2.87}{2} - 8.51) = -4.41$$

$$M_{CB} = (2.87 + \frac{2.67}{2} - 8.51) = -4.31$$

Panel 3

$$\begin{aligned} 1.78C - .21D &= 3.91 \\ -.26C + 1.76D &= 4.12 \end{aligned}$$

$$C = 2.52 \quad D = 2.71$$

$$R_3 = \frac{2.95 \times 2.52 + 2.90 \times 2.71 + 4.12}{3.90} = 8.04$$

$$M_{CD} = (2.52 + \frac{2.71}{2} - 8.04) = -4.17$$

$$M_{DC} = (2.71 + \frac{2.52}{2} - 8.04) = 4.07$$

Panel 4

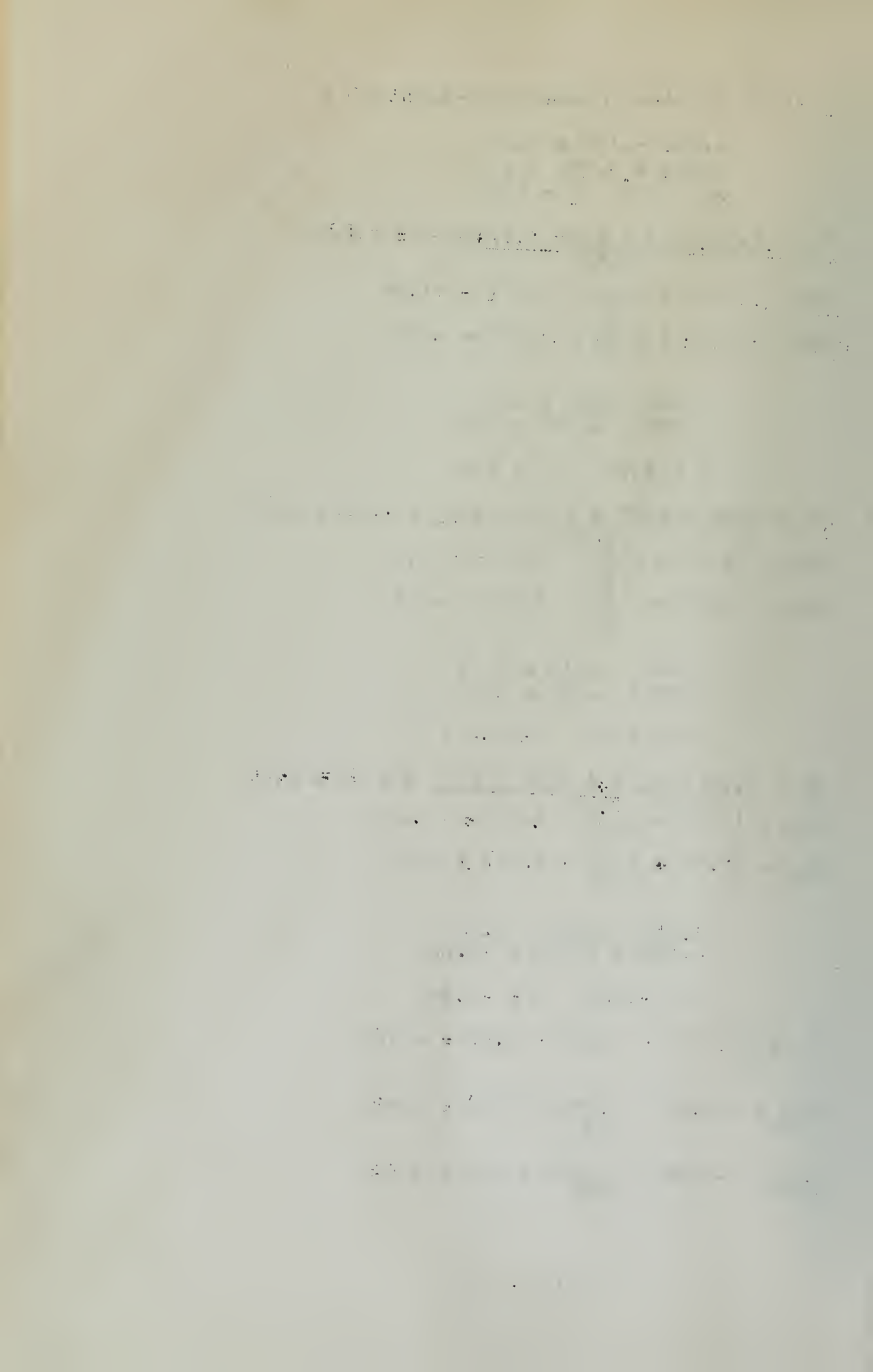
$$\begin{aligned} 1.75D - .25E &= -2.82 \\ -.25D + 1.75E &= -2.82 \end{aligned}$$

$$D = -1.88 \quad E = -1.88$$

$$R_4 = \frac{3(-1.88 - 1.88) - 2.82}{4} = -5.64$$

$$M_{DE} = (-1.88 - \frac{1.88}{2} + 5.64) = 2.82$$

$$M_{ED} = (-1.88 - \frac{1.88}{2} + 5.64) = 2.82$$



Panel 5

$$\begin{aligned}E &= -1.89 \\F &= -1.89 \\R_5 &= -5.64 \\M_{EF} &= 2.82 \\M_{FE} &= 2.82\end{aligned}$$

Panel 6

$$\begin{aligned}F &= -1.62 \\G &= -1.50 \\R_6 &= 4.80 \\M_{FG} &= 2.43 \\M_{GF} &= 2.49\end{aligned}$$

Panel 7

$$\begin{aligned}G &= -1.71 \\H &= -1.59 \\R_7 &= -5.10 \\M_{GH} &= 2.61 \\M_{HG} &= 2.67\end{aligned}$$

Panel 8

$$\begin{aligned}H &= -1.77 \\I &= -1.50 \\R_8 &= -5.13 \\M_{HI} &= 2.61 \\M_{IH} &= 2.79\end{aligned}$$

Joint Constant Computation - Load at E

Panel 1

$$1.82A - .17B = 3.26$$

$$.26A + 1.76B = 3.59$$

$$A = 2.01 \quad B = 2.34$$

$$R_1 = \frac{2.91 \times 2.01 + 2.83 \times 2.34}{3.82} + 3.59 = 6.86$$

$$M_{AB} = (2.01 + \frac{2.34}{2} - 6.86) = -3.68$$

$$M_{BA} = (2.34 + \frac{2.01}{2} - 6.86) = -3.52$$

Panel 2

$$1.78B - .21C = 3.31$$

$$.26B + 1.76C = 3.49$$

$$B = 2.13 \quad C = 2.30$$

$$R_2 = \frac{2.96 \times 2.13 + 2.91 \times 2.30}{3.92} + 3.49 = 6.81$$

$$M_{BC} = (2.13 + \frac{2.30}{2} - 6.81) = -3.53$$

$$M_{CB} = (2.30 + \frac{2.13}{2} - 6.81) = -3.45$$

Panel 3

$$1.78C - .21D = 3.13$$

$$.26C + 1.76D = 3.30$$

$$C = 2.01 \quad D = 2.17$$

$$R_3 = \frac{2.95 \times 2.01 + 2.90 \times 2.17}{3.90} + 3.30 = 6.44$$

$$M_{CD} = (2.01 + \frac{2.17}{2} - 6.44) = -3.35$$

$$M_{DC} = (2.17 + \frac{2.01}{2} - 6.44) = -3.27$$

Panel 4

$$1.75D - .25E = 3.75$$

$$.25D + 1.75E = 3.75$$

$$D = 2.50 \quad E = 2.50$$

$$R_4 = 3/4(2.50 + 2.50) + 3.75 = 7.50$$

$$M_{DE} = (2.50 + \frac{2.50}{2} - 7.50) = -3.75$$

$$M_{ED} = (2.50 + \frac{2.50}{2} - 7.50) = -3.75$$

Panel 5

$$E = -2.52$$

$$F = -2.52$$

$$R_5 = -7.52$$

$$M_{EF} = 3.76$$

$$M_{FE} = 3.76$$

Panel 6

$$E = -2.16$$

$$G = -2.00$$

$$E_5 = -6.40$$

$$M_{EG} = 3.24$$

$$M_{GE} = 3.24$$

Panel 7

$$G = -2.28$$

$$F = -2.12$$

$$R_7 = -6.80$$

$$M_{GH} = 3.48$$

$$M_{HG} = 3.56$$

Panel 8

$$H = -2.06$$

$$G = -2.00$$

$$R_8 = -6.80$$

$$M_{HI} = 3.48$$

$$M_{IH} = 3.72$$

Moment Corrections - Load at PPl

Panel 1

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = -1.22$$

$$A = -.07 \quad B = -.69$$

$$R_1 = \frac{-2.91 \times .07 - 2.83 \times .69}{3.83} = -.54$$

$$M_{AB} = 1(-.07 - \frac{1}{2} \times .69 + .54) = .12$$

$$M_{BA} = 1(-.69 - \frac{1}{2} \times .07 + .54) = -.18$$

Panel 2

$$1.78B - .20C = 6.16$$

$$-.26B + 1.76C = -1.21$$

$$B = 3.44 \quad C = -.18$$

$$R_2 = \frac{2.96 \times 3.44 - 2.91 \times .18}{3.91} = 2.47$$

$$M_{BC} = 1(3.44 - \frac{1}{2} \times .18 - 2.47) = .88$$

$$M_{CB} = 1(-.18 + \frac{1}{2} \times 3.44 - 2.47) = -.93$$

Panel 3

$$1.78C - .21D = -1.19$$

$$-.26C + 1.76D = -.94$$

$$C = -.74 \quad D = -.64$$

$$R_3 = \frac{-2.95 \times .74 - 2.90 \times .64}{3.90} = -1.04$$

$$M_{CD} = 1(-.74 - \frac{1}{2} \times .64 + 1.04) = -.02$$

$$M_{DC} = 1(-.64 - \frac{1}{2} \times .74 + 1.04) = .03$$

Panel 4

$$1.75D - .25E = -1.19$$

$$-.25D + 1.75E = -.94$$

$$D = -.77 \quad E = -.64$$

$$R_4 = 3/4(-.77 - .64) = -1.06$$

$$M_{DE} = 1(-.77 - \frac{1}{2} \times .64 + 1.06) = -.03$$

$$M_{ED} = 1(-.64 - \frac{1}{2} \times .77 + 1.06) = .03$$

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Panel 5

$$\begin{aligned} 1.75E - .25F &= -.94 \\ -.25E + 1.75F &= -.81 \end{aligned}$$

$$E = -.61$$

$$\begin{aligned} F &= -.54 \\ R_5 &= \frac{3}{4} (-.61 - .54) = -.86 \\ M_{EF} &= 1(-.61 - \frac{1}{2} \times .54 + .86) = -.02 \\ M_{FE} &= 1(-.54 - \frac{1}{2} \times .61 + .86) = .02 \end{aligned}$$

Panel 6

$$\begin{aligned} 1.76F - .26G &= -.94 \\ -.21F + 1.78G &= -.93 \end{aligned}$$

$$F = -.62$$

$$\begin{aligned} G &= -.56 \\ R_6 &= \frac{-2.90 \times .62 - 2.95 \times .56}{3.90} = -.88 \\ M_{FG} &= 1(-.62 - \frac{1}{2} \times .56 + .88) = 0 \\ M_{GF} &= 1(-.56 - \frac{1}{2} \times .62 + .88) = 0 \end{aligned}$$

Panel 7

$$\begin{aligned} 1.76G - .26H &= -.83 \\ -.20G + 1.78H &= -.87 \end{aligned}$$

$$G = -.55$$

$$H = -.55$$

$$\begin{aligned} R_7 &= \frac{-2.91 \times .55 - 2.96 \times .55}{3.91} = -.83 \\ M_{GH} &= 1(-.55 - \frac{1}{2} \times .55 + .83) = 0 \\ M_{HG} &= 1(-.55 - \frac{1}{2} \times .55 + .83) = 0 \end{aligned}$$

Panel 8

$$\begin{aligned} 1.76H - .26I &= -.89 \\ -.17H + 1.82I &= 0 \end{aligned}$$

$$H = -.51$$

$$I = -.05$$

$$\begin{aligned} R_8 &= \frac{-2.83 \times .51 - 2.91 \times .05}{3.83} = -.41 \\ M_{HI} &= 1(-.51 - \frac{1}{2} \times .05 + .42) = -.11 \\ M_{IH} &= 1(-.05 - \frac{1}{2} \times .51 + .42) = .11 \end{aligned}$$

Panel 1

$$1.82A - .17B = 0$$

$$-.26A + 1.76 = -.88$$

$$A = -.04$$

$$B = -.49$$

$$R_1 = \frac{-2.91 \times .04 - 2.83 \times .49}{3.83} = -.40$$

$$M_{AB} = (.04 - \frac{1}{2} \times .49 + .40) = .11$$

$$M_{BA} = (.49 - \frac{1}{2} \times .04 + .40) = -.11$$

Panel 3

$$1.78C - .21D = .93$$

$$-.26C + 1.76D = .03$$

$$C = .59$$

$$D = .10$$

$$R_3 = \frac{2.95 \times .59 - 2.90 \times .10}{3.90} = .52$$

$$M_{CD} = 1(.59 + \frac{1}{2} \times .10 - .52) = .12$$

$$M_{DC} = 1(.10 + \frac{1}{2} \times .59 - .52) = -.12$$

Load at B

| nel | 1 | | 2 | | 3 | | 4 | |
|------|-------|-------|-------|-------|-------|-------|-------|------|
| | A | B | B | C | C | D | D | E |
| Q | 5.77 | 6.28 | -1.15 | -1.21 | -1.13 | -1.19 | -.94 | -.94 |
| Y | 3.56 | 4.09 | -.74 | -.80 | -.73 | -.78 | -.63 | -.63 |
| R | 2.03 | | -2.36 | | -2.33 | | -1.88 | |
| M' | -6.43 | -6.16 | 1.22 | 1.19 | 1.21 | 1.19 | 0.94 | 0.94 |
| Q | 0 | -1.22 | 6.16 | -1.21 | -1.19 | -.94 | -1.19 | -.94 |
| Y | -.07 | -.69 | 3.44 | -.18 | -.74 | -.64 | -.77 | -.64 |
| R | -.54 | | 2.47 | | -1.04 | | -1.06 | |
| M'' | .12 | -.18 | .88 | -.93 | -.02 | .03 | -.03 | .03 |
| Q | 0 | -.88 | | | -.93 | .03 | | |
| Y | -.04 | -.49 | | | .59 | .10 | | |
| R | -.40 | | | | .52 | | | |
| M''' | .11 | -.11 | 0 | 0 | .12 | -.12 | 0 | 0 |
| M | -6.20 | -6.45 | 2.10 | .26 | 1.31 | 1.10 | .91 | .97 |

1. The first part of the document is a list of names and dates, arranged in a table-like format. The names are written in a cursive script, and the dates are in a more formal, printed style. The list appears to be a record of some kind, possibly a ledger or a list of transactions.

| Name | Date |
|----------|------|
| John Doe | 1875 |
| John Doe | 1876 |
| John Doe | 1877 |
| John Doe | 1878 |
| John Doe | 1879 |
| John Doe | 1880 |
| John Doe | 1881 |
| John Doe | 1882 |
| John Doe | 1883 |
| John Doe | 1884 |
| John Doe | 1885 |
| John Doe | 1886 |
| John Doe | 1887 |
| John Doe | 1888 |
| John Doe | 1889 |
| John Doe | 1890 |
| John Doe | 1891 |
| John Doe | 1892 |
| John Doe | 1893 |
| John Doe | 1894 |
| John Doe | 1895 |
| John Doe | 1896 |
| John Doe | 1897 |
| John Doe | 1898 |
| John Doe | 1899 |
| John Doe | 1900 |

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| John Doe | 1886 |
| John Doe | 1887 |
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| John Doe | 1889 |
| John Doe | 1890 |
| John Doe | 1891 |
| John Doe | 1892 |
| John Doe | 1893 |
| John Doe | 1894 |
| John Doe | 1895 |
| John Doe | 1896 |
| John Doe | 1897 |
| John Doe | 1898 |
| John Doe | 1899 |
| John Doe | 1900 |

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| John Doe | 1883 |
| John Doe | 1884 |
| John Doe | 1885 |
| John Doe | 1886 |
| John Doe | 1887 |
| John Doe | 1888 |
| John Doe | 1889 |
| John Doe | 1890 |
| John Doe | 1891 |
| John Doe | 1892 |
| John Doe | 1893 |
| John Doe | 1894 |
| John Doe | 1895 |
| John Doe | 1896 |
| John Doe | 1897 |
| John Doe | 1898 |
| John Doe | 1899 |
| John Doe | 1900 |

| Incl | 5 | | 6 | | 7 | | 8 | |
|------|-------|------|-------|------|-------|------|-------|------|
| | E | F | F | G | G | H | H | I |
| Q | -.94 | -.94 | -.82 | -.78 | -.87 | -.83 | -.90 | -.81 |
| | -.63 | -.63 | -.54 | -.50 | -.57 | -.53 | -.59 | -.50 |
| R | -1.88 | | -1.60 | | -1.70 | | -1.71 | |
| M' | .94 | .94 | .81 | .83 | .87 | .89 | .87 | .93 |
| Q | -.94 | -.81 | -.94 | -.87 | -.83 | -.87 | -.89 | 0 |
| | -.61 | -.54 | -.62 | -.56 | -.55 | -.55 | -.51 | -.05 |
| R | -.86 | | -.88 | | -.83 | | -.41 | |
| M'' | -.02 | .02 | 0 | 0 | 0 | 0 | -.11 | .11 |
| Q | | | | | | | | |
| R | | | | | | | | |
| M''' | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M | .92 | .96 | .81 | .83 | .87 | .89 | .76 | 1.04 |

19.

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1907

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Moment Corrections Load at C

Panel 1

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = 5.29$$

$$A = .29$$

$$B = 3.04$$

$$R_1 = \frac{2.91 \times .29 + 2.83 \times 3.04}{3.83} = 2.46$$

$$M_{AB} = 1(.29 + \frac{1}{2} \times 3.04 - 2.46) = -.65$$

$$M_{BC} = 1(3.04 + \frac{1}{2} \times .29 - 2.46) = .72$$

Panel 2

$$1.78B - .20C = 5.27$$

$$-.26B + 1.76 C = -2.40$$

$$B = 2.85$$

$$C = -.94$$

$$R_2 = \frac{2.96 \times 2.85 - 2.91 \times .94}{3.91} = 1.46$$

$$M_{BC} = 1(2.85 - \frac{1}{2} \times .94 - 1.46) = .92$$

$$M_{CB} = 1(-.94 + \frac{1}{2} \times 2.85 - 1.46) = -.98$$

Panel 3

$$1.78C - .21D = 5.17$$

$$-.26C + 1.76D = -1.87$$

$$C = 2.82$$

$$D = -.65$$

$$R_3 = \frac{2.95 \times 2.82 - 2.90 \times .65}{3.90} = 1.65$$

$$M_{CD} = 1(2.82 - \frac{1}{2} \times .65 - 1.65) = .85$$

$$M_{DC} = 1(-.65 + \frac{1}{2} \times 2.82 - 1.65) = -.89$$

Let V be a vector space over F .

Let T be a linear transformation on V .

Let λ be an eigenvalue of T .

Let v be an eigenvector of T .

Then $Tv = \lambda v$.

Let W be the subspace of V consisting of all eigenvectors of T .

Then W is a subspace of V .

Let U be the subspace of V consisting of all vectors v such that $Tv = \lambda v$.

Then U is a subspace of V .

Let $W = U$.

Then $W = U$.

Let W be the subspace of V consisting of all eigenvectors of T .

Then W is a subspace of V .

Let U be the subspace of V consisting of all vectors v such that $Tv = \lambda v$.

Then U is a subspace of V .

Let $W = U$.

Then $W = U$.

Let W be the subspace of V consisting of all eigenvectors of T .

Then W is a subspace of V .

Let U be the subspace of V consisting of all vectors v such that $Tv = \lambda v$.

nel 4

$$1.75D - .25E = -2.37$$

$$-.25D + 1.75E = -1.88$$

$$D = -1.54$$

$$E = -1.30$$

$$R_4 = \frac{3}{4} (-1.54 - 1.30) = -2.13$$

$$M_{DE} = 1(-1.54 - \frac{1}{2} \times 1.30 + 2.13) = -.06$$

$$M_{ED} = 1(-1.30 - \frac{1}{2} \times 1.54 + 2.13) = .06$$

anel 5

$$1.75 - .25F = -1.87$$

$$-.25E + 1.75F = -1.62$$

$$E = -1.23$$

$$F = -1.10$$

$$R_5 = \frac{3}{4} (-1.23 - 1.10) = -1.75$$

$$M_{EF} = 1(-1.23 - \frac{1}{2} \times 1.10 + 1.75) = -.03$$

$$M_{FE} = 1(-1.10 - \frac{1}{2} \times -1.23 + 1.75) = .03$$

anel 6

$$1.76F - .26G = -1.88$$

$$-.21F + 1.78G = -1.74$$

$$F = -1.22$$

$$G = -1.12$$

$$R_6 = \frac{-2.90 \times 1.22 - 2.95 \times 1.12}{3.90} = -1.75$$

$$M_{FG} = 1(-1.22 - \frac{1}{2} \times 1.12 + 1.75) = -.03$$

$$M_{GF} = 1(-1.12 - \frac{1}{2} \times 1.22 + 1.75) = .02$$

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1940

1941

1942

Panel 7

$$1.76G - .26H = -1.66$$

$$-.20G + 1.78H = -1.74$$

$$G = -1.10$$

$$H = -1.10$$

$$R_7 = \frac{-2.91 \times 1.10 - 2.96 \times 1.10}{3.91} = -1.65$$

$$M_{GH} = 1(-1.10 - \frac{1}{2} \times 1.10 + 1.65) = 0$$

$$M_{HG} = 1(-1.10 - \frac{1}{2} \times 1.10 + 1.65) = 0$$

Panel 8

$$1.76H - .26I = -1.78$$

$$-.17H + 1.82I = 0$$

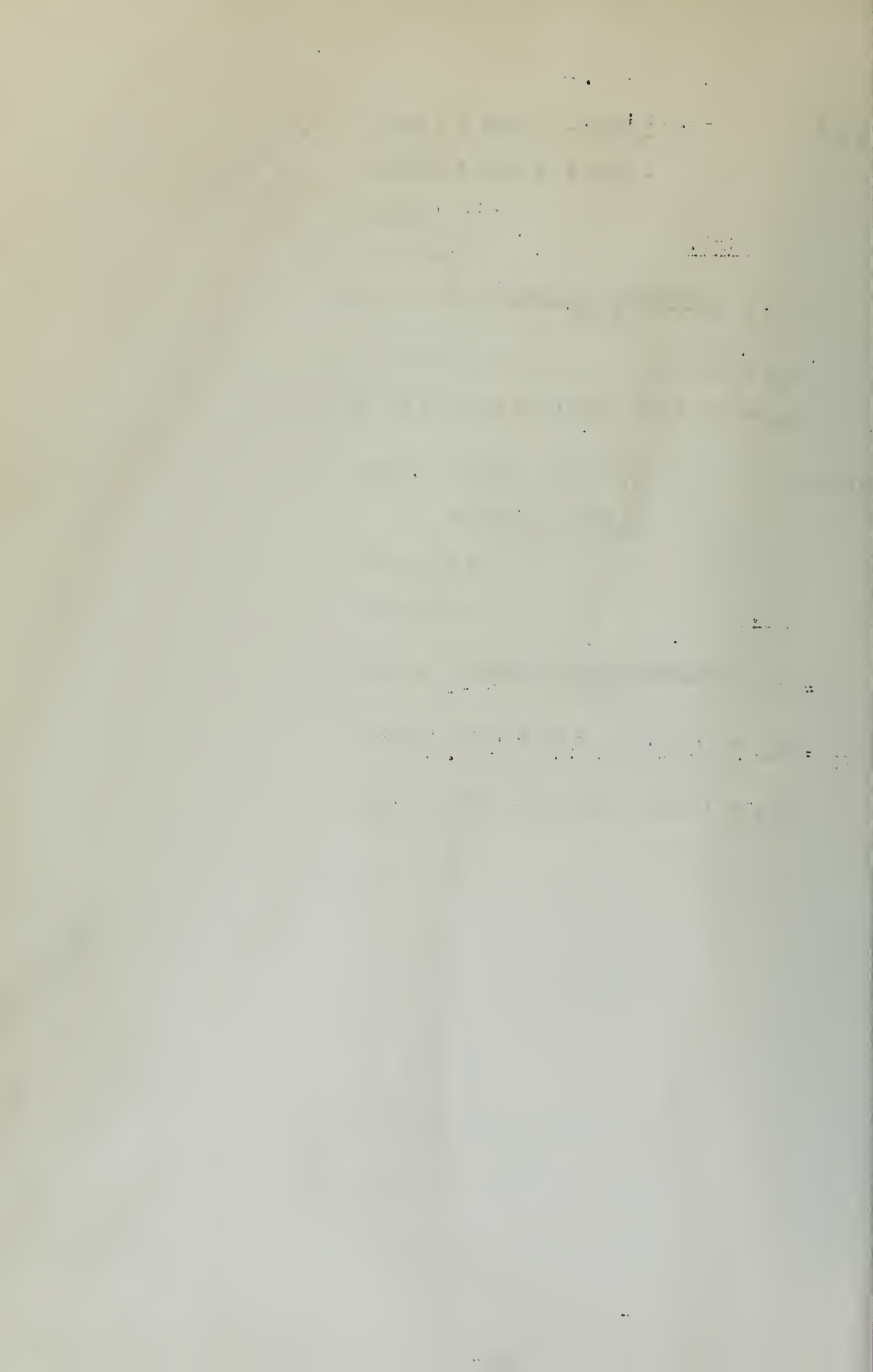
$$H = -1.02$$

$$I = -0.10$$

$$R_8 = \frac{-2.83 \times 1.02 - 2.91 \times .10}{3.83} = -.83$$

$$M_{HI} = 1(-1.02 - \frac{1}{2} \times .10 + .83) = -.24$$

$$M_{IH} = 1(-.10 - \frac{1}{2} \times 1.02 + .83) = .22$$



$$\begin{aligned}\text{Panel 1} \quad & 1.82A - .17B = 0 \\ & -.26A + 1.76B = -.92 \\ & A = -.05 \quad B = -.53\end{aligned}$$

$$R_1 = \frac{-2.91 \times .05 - 2.83 \times .53}{3.83} = -.43$$

$$M_{AB} = 1(-.05 - \frac{1}{2} \times .53 + .43) = .11$$

$$M_{BA} = 1(-.53 - \frac{1}{2} \times .05 + .43) = -.11$$

$$\begin{aligned}\text{Panel 2} \quad & 1.78B + .20C = .72 \\ & -.26B + 1.76C = -.85 \\ & B = -.46 \quad C = -.55\end{aligned}$$

$$R_2 = \frac{-2.96 \times .46 - 2.91 \times .55}{3.91} = -.76$$

$$M_{BC} = 1(-.46 - \frac{1}{2} \times .55 + .76) = .02$$

$$M_{CB} = 1(-.55 - \frac{1}{2} \times .46 + .76) = -.02$$

$$\begin{aligned}\text{Panel 3} \quad & 1.78C - .21D = .98 \\ & -.26C + 1.76D = .06 \\ & C = .56 \quad D = .12\end{aligned}$$

$$R_3 = \frac{2.95 \times .56 + 2.90 \times .12}{3.90} = .57$$

$$M_{CD} = 1(.56 + \frac{1}{2} \times .12 - .51) = .11$$

$$M_{DC} = 1(.12 + \frac{1}{2} \times .56 - .51) = -.11$$

$$\begin{aligned}\text{Panel 4} \quad & 1.75D - .25E = .89 \\ & -.25D + 1.75E = .03 \\ & D = .52 \quad E = .09\end{aligned}$$

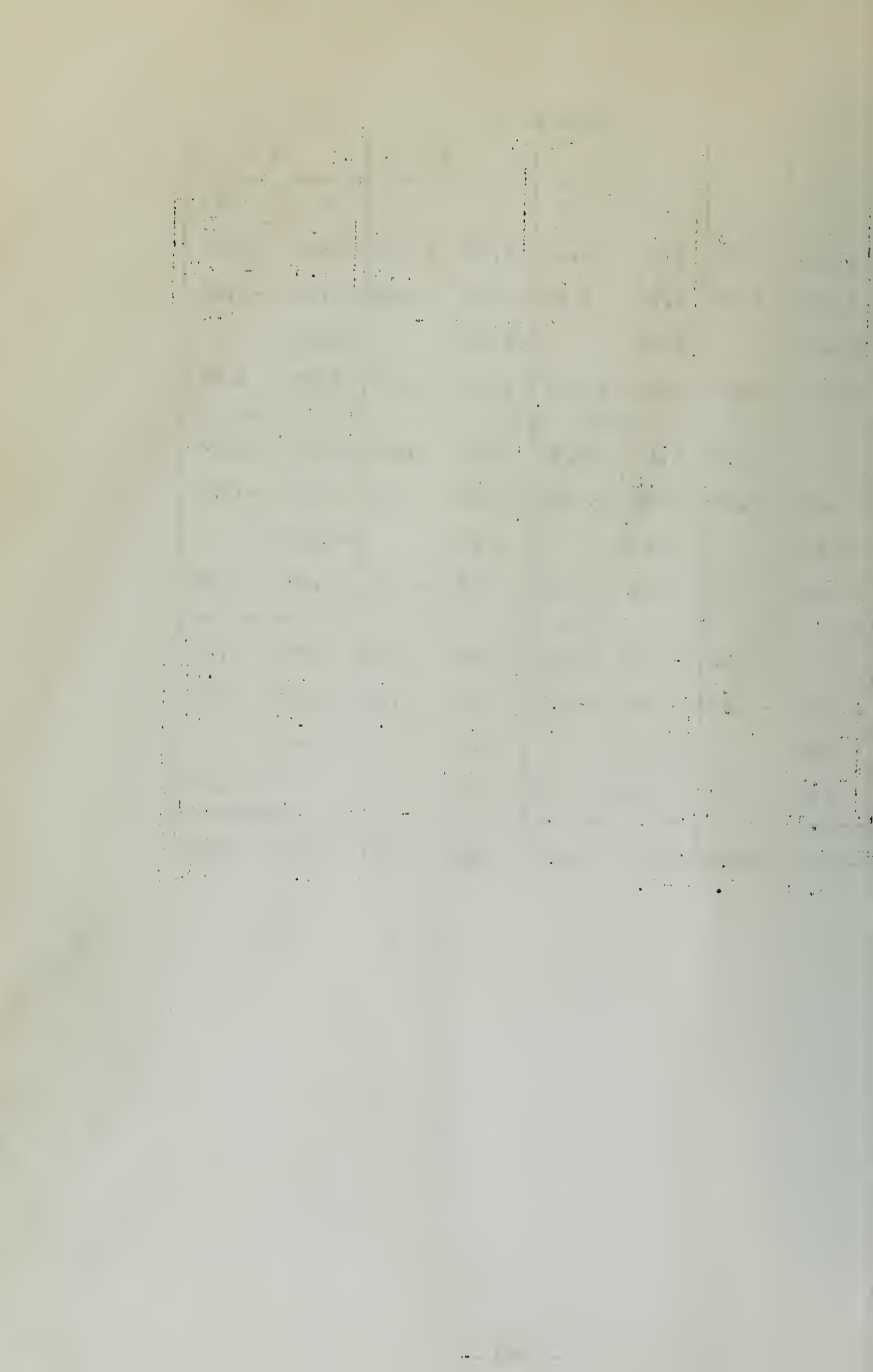
$$R_4 = 3/4(.52 + .09) = .46$$

$$M_{DE} = 1(.52 + \frac{1}{2} \times .09 - .46) = .11$$

$$M_{ED} = 1(.09 + \frac{1}{2} \times .52 - .46) = -.11$$

Load at C

| Panel | 1 | | 2 | | 3 | | 4 | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Joint | A | B | B | C | C | D | D | E |
| Q | 4.89 | 5.38 | 4.96 | 5.23 | -2.36 | -2.38 | -1.87 | -1.87 |
| x | 3.01 | 3.50 | 3.20 | 3.44 | -1.51 | -1.58 | -1.25 | -1.25 |
| R | 10.27 | | 10.21 | | -4.70 | | -3.74 | |
| M' | -5.41 | -5.27 | -5.29 | -5.17 | 2.40 | 2.37 | 1.87 | 1.87 |
| Q | 0 | 5.29 | 5.27 | -2.40 | 5.17 | -1.87 | -2.37 | -1.88 |
| x | .29 | 3.04 | 2.85 | -.94 | 2.82 | -.65 | -1.54 | -1.30 |
| R | 2.46 | | 1.46 | | 1.65 | | -2.13 | |
| M' | -.65 | .72 | .92 | -.98 | .85 | -.89 | -.06 | .06 |
| Q | 0 | -.92 | -.72 | -.85 | .98 | .06 | .89 | .03 |
| x | -.05 | -.53 | -.46 | -.55 | .56 | .12 | .52 | .09 |
| R | -.43 | | -.76 | | .51 | | .46 | |
| M'' | .11 | -.11 | .02 | -.02 | .11 | -.11 | .11 | -.11 |
| M | -6.05 | -4.65 | -4.35 | -6.17 | 3.36 | 1.37 | 1.92 | 1.82 |



| 5 | | 6 | | 7 | | 8 | |
|-------|-------|-------|-------|-------|-------|-------|-------|
| L | F | F | G | G | H | H | I |
| -1.88 | -1.88 | -1.64 | -1.56 | -1.74 | -1.66 | -1.80 | -1.62 |
| -1.26 | -1.26 | -1.08 | -1.00 | -1.14 | -1.06 | -1.18 | -1.10 |
| -3.76 | | -3.20 | | -3.40 | | -3.42 | |
| 1.88 | 1.88 | 1.62 | 1.66 | 1.74 | 1.78 | 1.74 | 1.86 |
| -1.87 | -1.62 | -1.88 | -1.74 | -1.66 | -1.74 | -1.78 | 0 |
| -1.23 | -1.10 | -1.22 | -1.12 | -1.10 | -1.10 | -1.02 | - .10 |
| -1.75 | | -1.75 | | -1.65 | | - .83 | |
| - .03 | .03 | - .03 | .02 | 0 | 0 | - .24 | .22 |
| - .06 | .03 | - .03 | 0 | - .02 | .24 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1.85 | 1.91 | 1.59 | 1.68 | 1.74 | 1.78 | 1.50 | 2.08 |

Influence Line Corrections - First Set

Panel 1

Load at D

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = 4.41$$

$$A = .24$$

$$B = 2.54$$

$$R_1 = 2.06$$

$$M_{AB} = (.24 + \frac{2.54}{2} - 2.06) = -.57$$

$$M_{BA} = (2.54 + \frac{.24}{2} - 2.06) = -.59$$

Panel 2

$$1.78B - .21C = 4.40$$

$$-.26B + 1.76C = 4.17$$

$$B = 2.80$$

$$C = 2.78$$

$$R_2 = 4.18$$

$$M_{BC} = (2.80 + \frac{2.78}{2} - 4.18) = 0$$

$$M_{CB} = (2.78 + \frac{2.80}{2} - 4.18) = 0$$

Panel 3

$$1.78C - .21D = 4.31$$

$$-.26C + 1.76D = -2.82$$

$$C = 2.27$$

$$D = -1.27$$

$$R_3 = .78$$

$$M_{CD} = (2.27 - \frac{1.27}{2} - .78) = .86$$

$$M_{DC} = (-1.27 + \frac{2.27}{2} - .78) = -.92$$

Panel 4

$$1.75D - .25E = 4.07$$

$$-.25D + 1.75E = -2.82$$

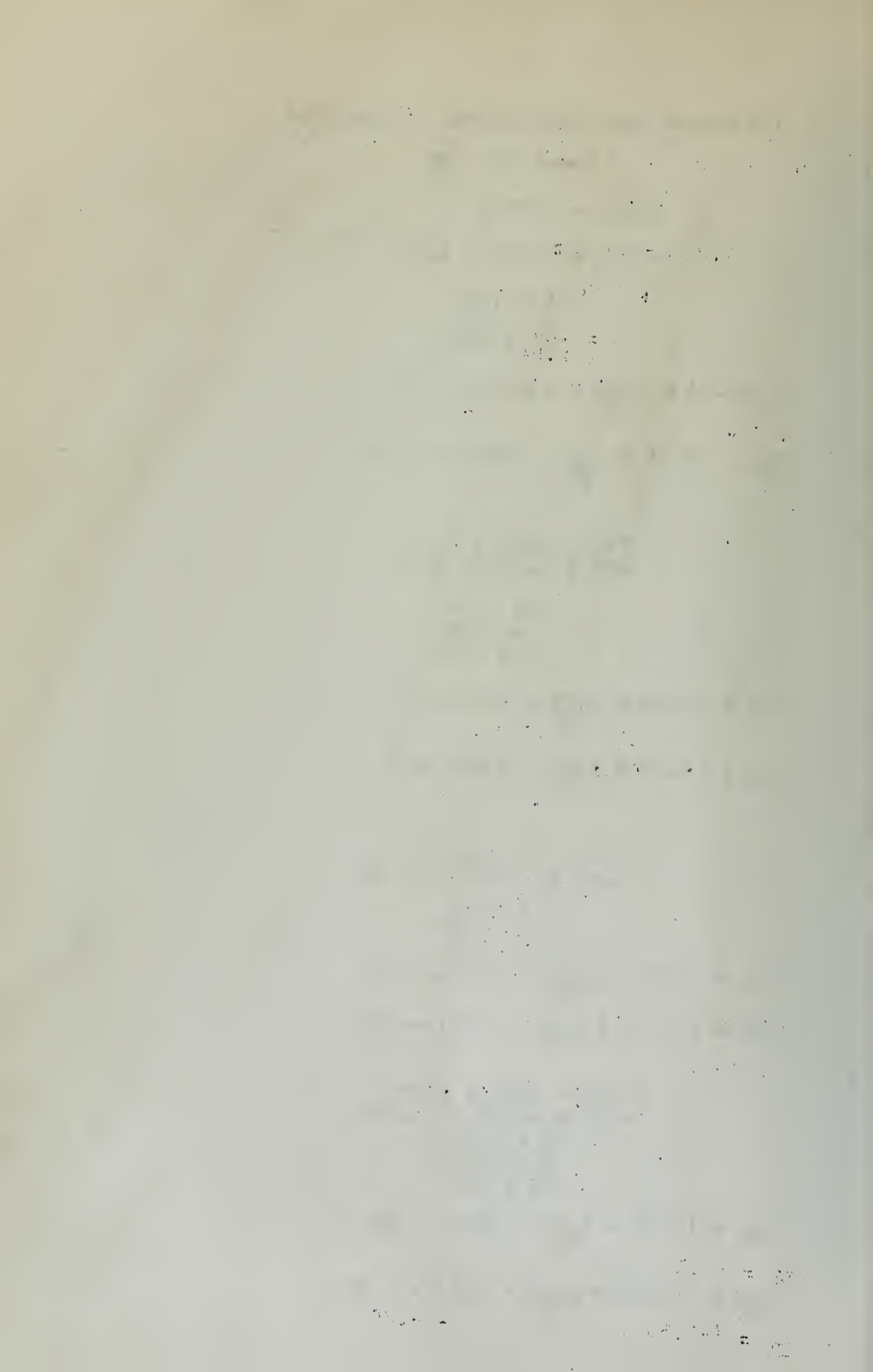
$$D = 2.14$$

$$E = -1.30$$

$$R_4 = .63$$

$$M_{DE} = (2.14 - \frac{1.30}{2} - .63) = .86$$

$$M_{ED} = (-1.30 + \frac{2.14}{2} - .63) = -.86$$



anel 5

$$\begin{aligned}-.25F + 1.75E &= -2.82 \\ 1.75F - .25E &= -2.43\end{aligned}$$

$$\begin{aligned}E &= -1.85 \\ F &= -1.65 \\ R_5 &= -2.63\end{aligned}$$

$$M_{EF} = (-1.85 - \frac{1.65}{2} + 2.63) = -.04$$

$$M_{FE} = (-1.65 - 1.85 + 2.63) = .06$$

anel 6

$$\begin{aligned}-.26G + 1.76F &= -2.82 \\ 1.78G - .21F &= -2.61\end{aligned}$$

$$\begin{aligned}F &= -1.85 \\ G &= -1.69 \\ R_6 &= -2.66\end{aligned}$$

$$M_{FG} = (-1.85 - \frac{1.69}{2} + 2.66) = -.03$$

$$M_{GF} = (-1.69 - \frac{1.85}{2} + 2.66) = .05$$

anel 7

$$\begin{aligned}-.26H + 1.76G &= -2.49 \\ 1.78H - .21G &= -2.61\end{aligned}$$

$$\begin{aligned}G &= -1.66 \\ H &= -1.66 \\ R_7 &= -2.49\end{aligned}$$

$$M_{GH} = (-1.66 - \frac{1.66}{2} + 2.49) = 0$$

$$M_{HG} = (-1.66 - \frac{1.66}{2} + 2.49) = 0$$

anel 8

$$\begin{aligned}-.26I + 1.76H &= -2.67 \\ 1.82I - .17H &= 0\end{aligned}$$

$$\begin{aligned}H &= -1.54 \\ I &= -.14 \\ R_8 &= -1.25\end{aligned}$$

$$M_{HI} = (-1.54 - \frac{.14}{2} + 1.25) = -.36$$

$$M_{IH} = (-.14 - \frac{1.54}{2} + 1.25) = .34$$

Influence Line Corrections-Load at D

Second Set

nel 1

0

nel 2

$$1.78B - .21C = .59$$

$$-.26B + 1.76C = -.86$$

$$B = -.40$$

$$C = -.55$$

$$R_2 = -.71$$

$$M_{BC} = (-.40 - \frac{.55}{2} + .71) = .04$$

$$M_{CB} = (-.55 - \frac{.40}{2} + .71) = -.04$$

nel 3

$$1.78C - .21D = 0$$

$$-.26C + 1.76D = -.86$$

$$C = -.06$$

$$D = -.50$$

$$R_3 = -.42$$

$$M_{CD} = (-.06 - \frac{.50}{2} + .42) = .11$$

$$M_{DC} = (-.50 - \frac{.06}{2} + .42) = -.11$$

nel 4

$$1.75D - .25E = .92$$

$$-.25D + 1.75E = .04$$

$$D = .54$$

$$E = .10$$

$$R_4 = .43$$

$$M_{DE} = (.54 + \frac{.10}{2} - .43) = .11$$

$$M_{ED} = (.10 + .54 - .43) = .11$$

Panel 5

$$-.25F + 1.75E = .86$$

$$1.75F - .25E = .03$$

$$E = .50$$

$$F = .09$$

$$R_5 = .44$$

$$M_{EF} = (.50 + \frac{.09}{2} - .44) = .10$$

$$M_{FE} = (.09 + \frac{.50}{2} - .44) = -.10$$

Panel 6

$$-.26G + 1.76F = -.06$$

$$1.78G - .21F = 0$$

$$F = -.35 \quad G = 0$$

$$M_{FG} = (-.35 - 0 + .26) = -.09$$

$$M_{GF} = (0 - .35 + .26) = .09$$

Panel 7

$$-.26H + 1.76G = -.03$$

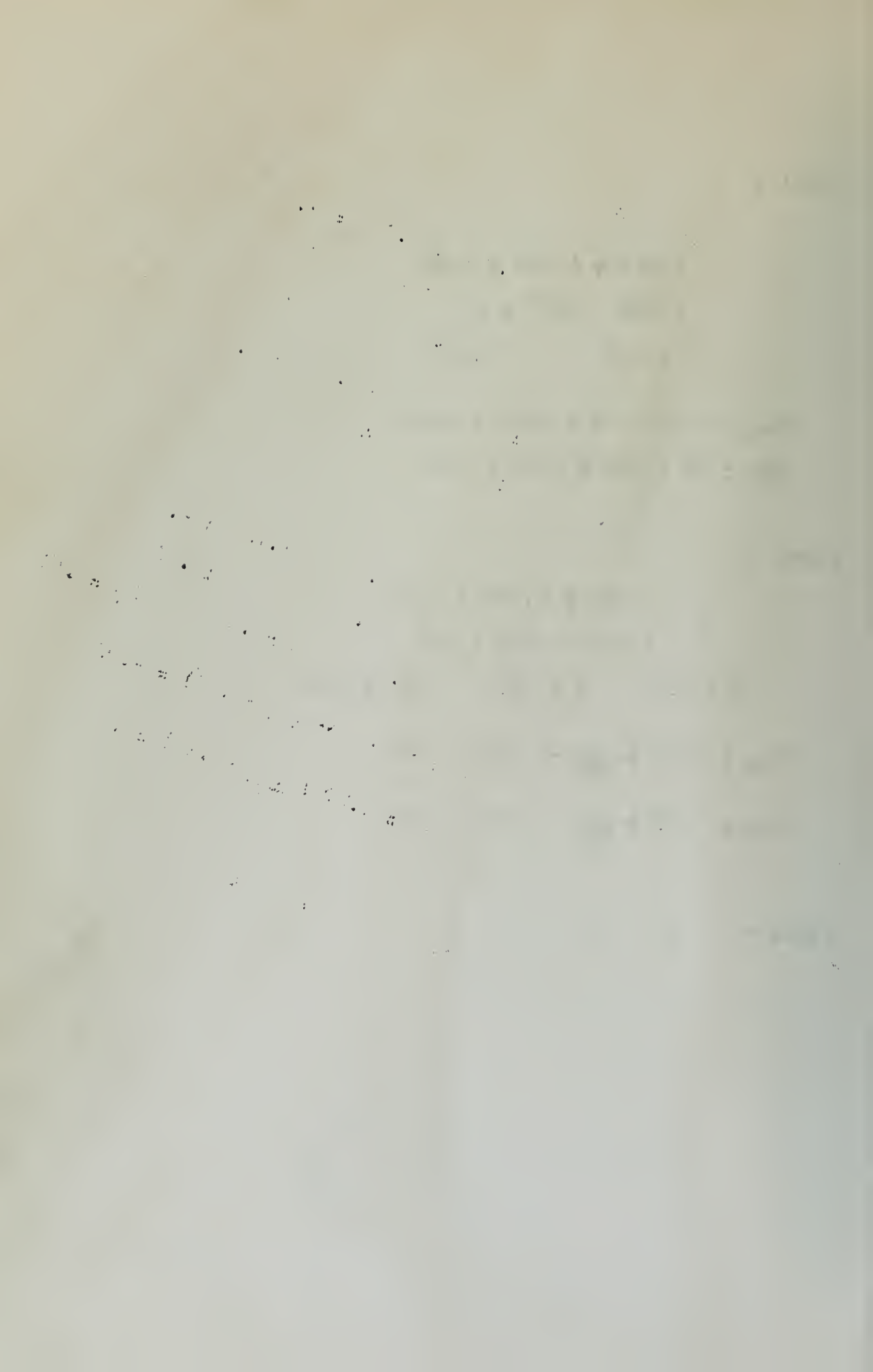
$$1.78H - .21G = .36$$

$$G = .01 \quad H = .20 \quad R_7 = .16$$

$$M_{GH} = (.01 + \frac{.20}{2} - .16) = -.05$$

$$M_{HG} = (.20 + \frac{.01}{2} - .16) = .04$$

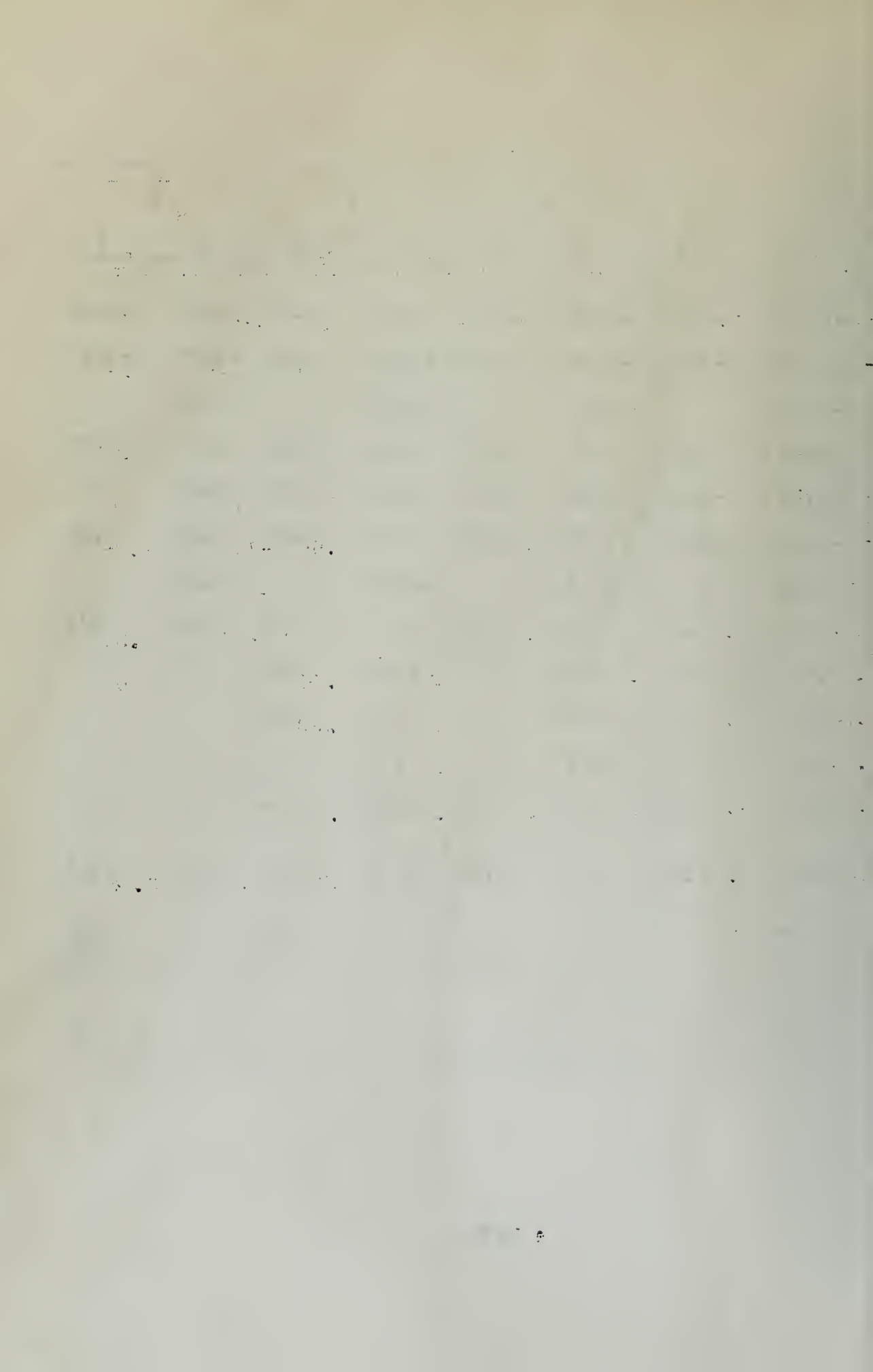
Panel 8 = 0



LOAD AT D

| Panel
Point | 1 | | 2 | | 3 | | 4 | |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | A | B | B | C | C | D | D | E |
| -Q | 4.12 | 4.49 | 4.14 | 4.36 | 3.91 | 4.12 | 2.82 | -2.82 |
| | 2.54 | 2.92 | 2.67 | 2.87 | 2.52 | 2.71 | -1.88 | -1.88 |
| R | 8.59 | | 8.51 | | 8.04 | | -5.64 | |
| M' | -4.59 | -4.40 | -4.41 | -4.31 | -4.17 | -4.07 | 2.82 | 2.82 |
| -Q | 0 | 4.41 | 4.40 | 4.17 | 4.31 | -2.82 | 4.07 | -2.82 |
| | .24 | 2.54 | 2.80 | 2.78 | 2.27 | -1.27 | 2.14 | -1.30 |
| R | 2.06 | | 4.18 | | .78 | | .63 | |
| M'' | -.57 | .59 | 0 | 0 | .86 | -.92 | .86 | -.86 |
| -Q | 0 | 0 | -.59 | -.86 | 0 | -.86 | .92 | .04 |
| | | | -.40 | -.55 | -.06 | -.50 | .54 | .10 |
| R | | | -.71 | | -.42 | | .48 | |
| M'' | 0 | 0 | .04 | -.04 | .11 | -.11 | .11 | -.11 |
| M | -5.16 | -3.81 | -4.37 | -4.35 | -3.20 | -5.10 | 3.79 | 1.85 |

| Panel | 5 | | 6 | | 7 | | 8 | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Point | E | F | F | G | G | H | H | I |
| -Q | -2.82 | -2.82 | -2.46 | -2.34 | -2.61 | -2.49 | -2.70 | -2.43 |
| Q | -1.89 | -1.82 | -1.62 | -1.50 | -1.71 | -1.59 | -1.77 | -1.50 |
| R | -5.34 | | -4.80 | | -5.10 | | -5.13 | |
| M' | 2.82 | 2.82 | 2.43 | 2.49 | 2.61 | 2.67 | 2.61 | 2.79 |
| -Q | -2.82 | -2.43 | -2.32 | -2.61 | -2.49 | -2.61 | -2.67 | 0 |
| Q | -1.85 | -1.65 | -1.69 | -1.85 | -1.66 | -1.66 | -1.54 | -.14 |
| R | -2.63 | | -2.56 | | -2.49 | | -1.25 | |
| M" | -.04 | .06 | -.03 | .05 | 0 | 0 | -.36 | .34 |
| -Q | .86 | .05 | -.06 | 0 | -.03 | .36 | 0 | 0 |
| Q | .50 | .09 | -.35 | 0 | .01 | .20 | | |
| R | .44 | | -.26 | | .15 | | | |
| M" | .10 | -.10 | -.09 | .09 | -.05 | .04 | 0 | 0 |
| ΣM | 2.88 | 2.78 | 2.33 | 2.61 | 2.53 | 2.71 | 2.25 | 3.13 |



Influence Line Corrections-Load at E
First Set

Panels 1,8

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = 3.53$$

$$A = -.19 \quad B = 2.03 \quad R_1 = 1.65$$

$$M_{AB} = (.19 + \frac{2.03}{2} - 1.65) = -.45$$

$$M_{BA} = (2.03 + \frac{.19}{2} - 1.65) = .47$$

Panel 2,7

$$1.78B - .21C = 3.48$$

$$-.26B + 1.76C = 3.24$$

$$B = 2.21 \quad C = 2.17 \quad R_2 = 3.28$$

$$M_{BC} = (2.21 + \frac{2.17}{2} - 3.28) = .01$$

$$M_{CB} = (2.17 + \frac{2.21}{2} - 3.28) = -.01$$

Panels 3,6

$$1.78C - .21D = 3.45$$

$$-.26C + 1.76D = 3.76$$

$$C = 2.23 \quad D = 2.46 \quad R_3 = 3.52$$

$$M_{CD} = (2.23 + \frac{2.46}{2} - 3.52) = -.06$$

$$M_{DC} = (2.46 + \frac{2.23}{2} - 3.52) = .05$$

Panels 4,5

$$1.75D - .25E = 3.24$$

$$-.25D + 1.75E = -3.76$$

$$D = 1.58 \quad E = -1.92 \quad R_4 = -.25$$

$$M_{DE} = (1.58 + \frac{1.92}{2} + .25) = .87$$

$$M_{ED} = (-1.92 + \frac{1.58}{2} + .25) = -.88$$

Influence Line Corrections-Load at E Second Set

panels 1,8

0

panels 2,7

$$1.78B - .21C = -.47$$

$$-.26B + 1.76C = .06$$

$$B = -.26 \quad C = -.01 \quad R_2 = -.20$$

$$M_{BC} = (.01 - \frac{.26}{2} + .20) = .06$$

$$M_{CB} = (-.01 - .26 + 2.0) = .06$$

panels 3,6

$$1.75C - .21D = .01$$

$$-.26C + 1.76D = -.87$$

$$C = -.05 \quad D = -.50 \quad R_3 = -.41$$

$$M_{CD} = (.05 - \frac{.50}{2} + .41) = .11$$

$$M_{DC} = (-.50 - \frac{.05}{2} + .41) = -.11$$

panels 4,5

$$1.75D - .25E = -.05$$

$$-.25D + 1.75E = -.88$$

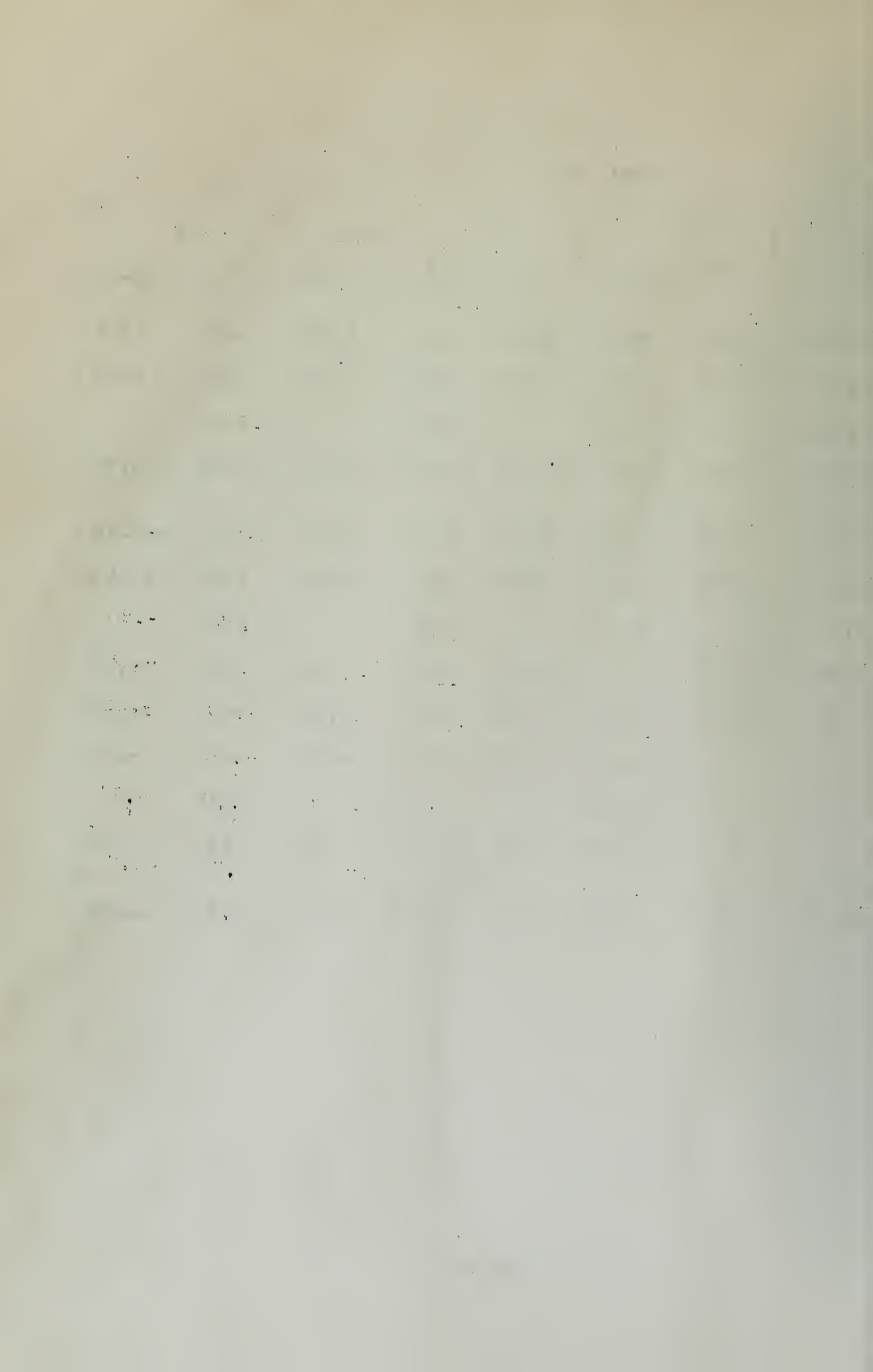
$$D = -.10 \quad E = -.52 \quad R_4 = -.46$$

$$M_{DE} = (-.10 - \frac{.52}{2} + .46) = .10$$

$$M_{ED} = (-.52 - \frac{.10}{2} + .46) = -.11$$

Load at E

| Inel
Point | 1 | | 2 | | 3 | | 4 | |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | A | B | B | C | C | D | D | E |
| | 3.24 | 3.60 | 3.32 | 3.48 | 3.12 | 3.28 | 3.76 | 3.76 |
| | 2.00 | -2.36 | 2.12 | 2.28 | 2.00 | 2.16 | 2.52 | 2.52 |
| | 6.84 | | 6.81 | | 6.40 | | 7.52 | |
| | -3.72 | -3.48 | -3.53 | -3.45 | -3.24 | -3.24 | -3.76 | -3.76 |
| | 0 | 3.53 | 3.48 | 3.24 | 3.45 | 3.76 | 3.24 | -3.76 |
| | .19 | 2.03 | 2.31 | 2.17 | 2.23 | 2.46 | 1.58 | -1.92 |
| | 1.65 | | 3.28 | | 3.52 | | -.25 | |
| | -.45 | .47 | .01 | -.01 | -.06 | .05 | .87 | -.88 |
| | 0 | -.01 | -.47 | .06 | .01 | -.87 | -.05 | -.88 |
| | | | -.26 | -.01 | -.05 | -.50 | -.10 | -.52 |
| | | | -.20 | | -.41 | | -.46 | |
| | | | -.06 | .06 | .11 | -.11 | .10 | -.11 |
| | -4.17 | -3.01 | -3.58 | -3.40 | -3.19 | -3.30 | -2.79 | -4.75 |



Moment Computations

| | | |
|---------------|---------|--------------|
| Member AA' | DL | = 3422 fk |
| | LL E-60 | = 3005 |
| | Impact | = <u>643</u> |
| | Total | 7070 |
| LL H15-S12-44 | | = 401 |
| Conc. | | = 91 |
| Impact | | = <u>68</u> |
| Total | | 560 |
| Sidewalk | | = 259 |
| Design Moment | | = 7,869 fk |
| Member BB' | DL | = 4680 fk |
| | LL E-60 | = 3990 |
| | Impact | = <u>835</u> |
| | Total | 9505 |
| LL H15-S12-44 | | = 548 |
| Conc. | | = 128 |
| Impact | | = <u>93</u> |
| Total | | 769 |
| Sidewalk | | = 326 |
| Design Moment | | = 10,600 fk |
| Member CC' | DL | = 3230 fk |
| | LL E-60 | = 2945 |
| | Impact | = <u>728</u> |
| | Total | 6953 |
| LL H15-S12-44 | | = 384 |
| Conc. | | = 115 |
| Impact | | = <u>82</u> |
| Total | | 581 |
| Sidewalk | | = 247 |
| Design Moment | | = 7,781 fk |

| nel
Int | 5 | | 6 | | 7 | | 8 | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | E | F | F | G | G | H | H | I |
| -Q | -3.76 | -3.76 | -3.28 | -3.12 | -3.48 | -3.32 | -3.60 | -3.24 |
| C | -2.52 | -2.52 | -2.16 | -2.00 | -2.28 | -2.12 | -2.36 | -2.00 |
| R | -7.52 | | -6.40 | | -6.81 | | -6.84 | |
| M' | 3.76 | 3.76 | 3.24 | 3.24 | 3.45 | 3.53 | 3.48 | 3.72 |
| -Q | 3.76 | -3.23 | -3.76 | -3.45 | -3.24 | -3.48 | -3.53 | 0 |
| | 1.92 | -1.58 | -2.46 | -2.23 | -2.17 | -2.21 | -2.03 | -.19 |
| R | .25 | | -3.52 | | -3.28 | | -1.65 | |
| M'' | .88 | -.87 | -.05 | .06 | .01 | -.01 | -.47 | .45 |
| Q | .88 | .05 | .87 | -.01 | -.06 | .47 | .01 | 0 |
| C | .52 | .10 | .50 | .05 | .01 | .26 | | |
| R | .46 | | .41 | | .20 | | | |
| M'' | .11 | -.10 | .11 | -.11 | -.06 | .06 | 0 | 0 |
| M | 4.75 | 2.79 | 3.30 | 3.19 | 3.40 | 3.58 | 3.01 | 4.17 |
| | | | | | | | | |
| | | | | | | | | |

Member DL'

| | | | |
|---------------|---|------------|----|
| DL | = | 2132 | fk |
| LL-E60 | = | 1950 | |
| Impact | = | <u>536</u> | |
| Total | = | 4618 | |
| LL-H15-S12-44 | = | 240 | |
| Conc. | = | 88 | |
| Impact | = | <u>53</u> | |
| Total | = | 381 | |
| Sidewalk | = | 171 | |
| Design Moment | = | 5,170 | fk |

Member EE'

| | | | |
|---------------|---|------------|----|
| DL | = | 1267 | fk |
| LL-E60 | = | 1213 | |
| Impact | = | <u>425</u> | |
| Total | = | 2905 | |
| Sidewalk | = | 114 | |
| Design Moment | = | 3,282 | fk |

Member AB

| | | | |
|---------------|---|------------|----|
| DL | = | 3422 | fk |
| LL-E60 | = | 5005 | |
| Impact | = | <u>643</u> | |
| Total | = | 7070 | |
| LL-H15-S12-44 | = | 401 | |
| Conc. | = | 91 | |
| Impact | = | <u>68</u> | |
| Total | = | 560 | |
| Sidewalk | = | 239 | |
| Design Moment | = | 7,689 | fk |

Member BC

| | | | |
|---------------|---|------------|----|
| DL | = | 2326 | fk |
| LL-E60 | = | 2092 | |
| Impact | = | <u>481</u> | |
| Total | = | 4849 | |
| LL-H15-S12-44 | = | 272 | |
| Conc. | = | 75 | |
| Impact | = | <u>52</u> | |
| Total | = | 397 | |
| Sidewalk | = | 169 | |
| Design Moment | = | 5,465 | fk |

Member CD

| | | | |
|---------------|---|------------|----|
| DL | = | 1666 | fk |
| LL-E60 | = | 1551 | |
| Impact | = | <u>398</u> | |
| Total | = | 3615 | |
| LL-H15-H12-44 | = | 195 | |
| Conc. | = | 64 | |
| Impact | = | <u>44</u> | |
| Total | = | 303 | |
| Sidewalk | = | 125 | |
| Design Moment | = | 4,043 | fk |

Member DE

| | | | |
|---------------|---|------------|----|
| DL | = | 1192 | fk |
| LL-E60 | = | 1150 | |
| Impact | = | <u>345</u> | |
| Total | = | 2687 | |
| LL-H15-S12-44 | = | 140 | |
| Conc. | = | 56 | |
| Impact | = | <u>57</u> | |
| Total | = | 233 | |
| Sidewalk | = | 100 | |
| Design Moment | = | 3,020 | fk |

Influence Line Computations - Fourth Set

Load at B

Panel 1

$$-Q_A = \frac{(.0942 - 4)(.0866 \times 26.25 - .875 \times 30)}{2(2 - .0866)4} = 6.14$$

$$-Q_B = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)} = 6.28$$

$$Q_{R1} = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)4} = 1.57$$

Panel 2

$$-Q_B = \frac{(.0463 \times 1 - 4)(.0443 \times 22.5 + .125 \times 30)}{2(2 - .0443)4} = -1.20$$

$$-Q_C = \frac{(-.125 \times 30 - 22.5 \times .0443)}{2(2 - .0443)} = -1.21$$

$$Q_{R2} = \frac{(-.125 \times 30 - 22.5 \times .0443)}{2(2 - .0443)4} = -.30$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 3)(.0482 \times 18.75 + .125 \times 30)}{2(2 - .0482)3} = -1.16$$

$$-Q_D = \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)} = -1.19$$

$$Q_{R3} = \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)3} = -.40$$

Panel 4

$$-Q_D = \frac{-2(.125 \times 30)}{4 \times 2} = -.94$$

$$-Q_E = \frac{(-.125 \times 30)}{4} = -.94$$

$$Q_{R4} = \frac{(-.125 \times 30)}{4 \times 2} = -.47$$

$$x_{n+1} = \frac{(x_n^2 + y_n^2) - (x_n^2 - y_n^2)}{2} = \frac{y_n^2}{2}$$

$$y_{n+1} = \frac{(x_n^2 + y_n^2) + (x_n^2 - y_n^2)}{2} = x_n^2$$

$$x_{n+2} = \frac{(x_{n+1}^2 + y_{n+1}^2) - (x_{n+1}^2 - y_{n+1}^2)}{2} = \frac{y_{n+1}^2}{2}$$

$$y_{n+2} = \frac{(x_{n+1}^2 + y_{n+1}^2) + (x_{n+1}^2 - y_{n+1}^2)}{2} = x_{n+1}^2$$

$$x_{n+3} = \frac{(x_{n+2}^2 + y_{n+2}^2) - (x_{n+2}^2 - y_{n+2}^2)}{2} = \frac{y_{n+2}^2}{2}$$

$$y_{n+3} = \frac{(x_{n+2}^2 + y_{n+2}^2) + (x_{n+2}^2 - y_{n+2}^2)}{2} = x_{n+2}^2$$

$$x_{n+4} = \frac{(x_{n+3}^2 + y_{n+3}^2) - (x_{n+3}^2 - y_{n+3}^2)}{2} = \frac{y_{n+3}^2}{2}$$

$$y_{n+4} = \frac{(x_{n+3}^2 + y_{n+3}^2) + (x_{n+3}^2 - y_{n+3}^2)}{2} = x_{n+3}^2$$

$$x_{n+5} = \frac{(x_{n+4}^2 + y_{n+4}^2) - (x_{n+4}^2 - y_{n+4}^2)}{2} = \frac{y_{n+4}^2}{2}$$

$$y_{n+5} = \frac{(x_{n+4}^2 + y_{n+4}^2) + (x_{n+4}^2 - y_{n+4}^2)}{2} = x_{n+4}^2$$

$$x_{n+6} = \frac{(x_{n+5}^2 + y_{n+5}^2) - (x_{n+5}^2 - y_{n+5}^2)}{2} = \frac{y_{n+5}^2}{2}$$

$$y_{n+6} = \frac{(x_{n+5}^2 + y_{n+5}^2) + (x_{n+5}^2 - y_{n+5}^2)}{2} = x_{n+5}^2$$

Panel 5

$$-Q_E = \frac{-.125 \times 30}{4} = -0.94$$

$$-Q_T = \frac{-.125 \times 30}{4} = -0.94$$

$$Q_{R5} = \frac{-.125 \times 30}{4 \times 2} = -0.47$$

Panel 6

$$-Q_T = \frac{(-.125 \times 30 + .0482 \times 30)}{2(2 - .0482)} = -0.82$$

$$-Q_G = \frac{(.0507 \times 2 - 3)(-.0482 \times 11.25 + .125 \times 30)}{2(2 - .0482)3} = -0.79$$

$$Q_{R6} = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)3} = -0.27$$

Panel 7

$$-Q_G = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)} = -0.87$$

$$-Q_H = \frac{(.0463 \times 1 - 4)(-.0443 \times 7.5 + .125 \times 30)}{2(2 - .0443)4} = -0.86$$

$$Q_{R7} = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)4} = -0.22$$

Panel 8

$$-Q_H = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)} = -0.90$$

$$-Q_I = \frac{(.0942 \times 1 - 4)(-.0866 \times 3.75 + .125 \times 30)}{2(2 - .0866)4} = -0.88$$

$$Q_{R8} = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)4} = -0.22$$

Load at C

Panel 1

$$-Q_A = \frac{(.0942 \times 1 - 4)(.0866 \times 22.5 - .75 \times 30)}{2(2 - .0866)4} = 5.27$$

$$-Q_B = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R1} = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)4} = 1.35$$

Panel 2

$$-Q_B = \frac{(.0463 \times 1 - 4)(.0443 \times 45 - .75 \times 30)}{2(2 - .0443)4} = 5.17$$

$$-Q_C = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)} = 5.23$$

$$Q_{R2} = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)4} = 1.31$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 3)(.0482 \times 37.5 + .25 \times 30)}{2(2 - .0482)3} = -2.31$$

$$-Q_D = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)} = -2.38$$

$$Q_{R3} = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)3} = -.79$$

Panel 4

$$-Q_D = \frac{-2(.25 \times 30)}{4 \times 2} = -1.87$$

$$-Q_E = \frac{(-.25 \times 30)}{4} = -1.87$$

$$Q_{R4} = \frac{-.25 \times 30}{4 \times 2} = -.94$$

1. The first part of the paper is devoted to a general discussion of the problem.

2. In the second part, we shall consider the case of a single particle.

3. The third part is devoted to the case of a system of particles.

4. In the fourth part, we shall consider the case of a continuous medium.

5. The fifth part is devoted to the case of a system of continuous media.

6. In the sixth part, we shall consider the case of a system of systems.

7. The seventh part is devoted to the case of a system of systems of systems.

8. In the eighth part, we shall consider the case of a system of systems of systems of systems.

9. The ninth part is devoted to the case of a system of systems of systems of systems of systems.

10. In the tenth part, we shall consider the case of a system of systems of systems of systems of systems of systems.

11. The eleventh part is devoted to the case of a system of systems of systems of systems of systems of systems of systems.

12. In the twelfth part, we shall consider the case of a system of systems of systems of systems of systems of systems of systems of systems.

13. The thirteenth part is devoted to the case of a system of systems of systems of systems of systems of systems of systems of systems of systems.

Panel 5

$$-Q_T = -1.88$$

$$-Q_F = -1.88$$

$$Q_{R5} = -0.94$$

Panel 6

$$-Q_T = -1.64$$

$$-Q_G = -1.58$$

$$Q_{R6} = -0.54$$

Panel 7

$$-Q_G = -1.74$$

$$-Q_H = -1.72$$

$$Q_{R7} = -0.44$$

Panel 8

$$-Q_H = -1.80$$

$$-Q_I = -1.76$$

$$Q_{R8} = -0.45$$

Load at D

Panel 1

$$-Q_A = \frac{(.0942 \times 1 - 4)(.0866 \times 18.75 - .625 \times 30)}{2(2 - .0866)4} = 4.38$$

$$-Q_B = \frac{(.625 \times 30 - .0866 \times 18.75)}{2(2 - .0866)} = 4.49$$

$$Q_{R1} = \frac{(.625 \times 30 - .0866 \times 18.75)}{2(2 - .0866)4} = 1.12$$

Panel 2

$$-Q_B = \frac{(.0463 \times 1 - 4)(.0443 \times 37.5 - .625 \times 30)}{2(2 - .0443)4} = 4.31$$

$$-Q_C = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)} = 4.36$$

$$Q_{R2} = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)4} = 1.09$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 3)(.0482 \times 56.25 - .625 \times 30)}{2(2 - .0482)3} = 3.98$$

$$-Q_D = \frac{(.625 \times 30 - .0482 \times 56.25)}{2(2 - .0482)} = 4.12$$

$$Q_{R3} = \frac{(.625 \times 30 - .0482 \times 56.25)}{2(2 - .0482)3} = 1.37$$

Panel 4

$$-Q_D = \frac{-2(.375 \times 30)}{4 \times 2} = -2.82$$

$$-Q_E = \frac{(-.375 \times 30)}{4} = -2.82$$

$$Q_{R4} = \frac{(-.375 \times 30)}{4 \times 2} = -1.41$$

Panel 5

$$-Q_E = -2.82$$

$$-Q_F = -2.82$$

$$Q_{R5} = -1.41$$

Panel 6

$$-Q_I = -2.46$$

$$-Q_G = -2.37$$

$$Q_{R6} = -0.81$$

Panel 7

$$-Q_G = -2.61$$

$$-Q_H = -2.58$$

$$Q_{R7} = -0.66$$

Panel 8

$$-Q_H = -2.70$$

$$-Q_I = -2.64$$

$$Q_{R8} = -0.67$$

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Load at E

Panel 1

$$-Q_A = \frac{(.0942 \times 1 - 4)(.0866 \times 15 - .5 \times 30)}{2(2 - .0866)4} = 3.51$$

$$-Q_B = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)} = 3.59$$

$$Q_{R_1} = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)4} = .90$$

Panel 2

$$-Q_B = \frac{(.0463 \times 1 - 4)(.0443 \times 30 - .5 \times 30)}{2(2 - .0443)4} = 3.44$$

$$-Q_C = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)} = 3.49$$

$$Q_{R_2} = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)4} = .87$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 3)(.0482 \times 45 - .5 \times 30)}{2(2 - .0482)3} = 3.18$$

$$-Q_D = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)} = 3.30$$

$$Q_{R_3} = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)3} = 1.10$$

Panel 4

$$-Q_D = \frac{-2(-.5 \times 30)}{4 \times 2} = 3.75$$

$$-Q_E = \frac{(.5 \times 30)}{4} = 3.75$$

$$Q_{R_4} = \frac{(.5 \times 30)}{4 \times 2} = 1.88$$

Panel 5

$$-Q_E = -3.76$$

$$-Q_F = -3.76$$

$$Q_{R_5} = -1.88$$

Panel 6

$$-Q_F = -3.28$$

$$-Q_G = -3.16$$

$$Q_{R_6} = -1.08$$

Panel 7

$$-Q_G = -3.48$$

$$-Q_H = -3.44$$

$$Q_{R_7} = -0.88$$

Panel 8

$$-Q_H = -3.60$$

$$-Q_I = -3.52$$

$$Q_{R_8} = -0.90$$

Determination of formulae for Panel Constant Computations

el 1

$$5 + 4 + \left[\frac{(3 - .0866)(.0942 - 4)}{2(2 - .0866)} \right] A + \left[2 + \frac{(3 - .1732)(.0942 - 4)}{2(2 - .0866)} \right] B = -Q_A$$

$$2.52A - .90B = -Q_A$$

$$1.5 - \left[\frac{(3 - .1732)4}{2(2 - .0866)} \right] B + \left[2 - \frac{(3 - .0866)4}{2(2 - .0866)} \right] A = -Q_B$$

$$2.54B - 1.04A = -Q_B$$

el 2

$$5 + 4 + \left[\frac{(3 - .0443)(.0463 - 4)}{2(2 - .0443)} \right] A + \left[2 + \frac{(3 - .0886)(.0463 - 4)}{2(2 - .0443)} \right] B = -Q_A$$

$$2.52A - .93B = -Q_A$$

$$3 - \left[\frac{(3 - .0886)4}{2(2 - .0443)} \right] B + \left[2 - \frac{(3 - .0443)4}{2(2 - .0443)} \right] A = -Q_B$$

$$4.03B - 1.02A = -Q_B$$

nel 3

$$5x2 + 3 + \left[\frac{(3 - .0482)(.0507x2 - 3)}{2(2 - .0482)} \right] A + \left[1.5 + \frac{(3 - .0946)(.0507x2 - 3)}{2(2 - .0482)} \right] B = -Q_A$$

$$3.31A - .65B = -Q_A$$

$$4.5 - \left[\frac{(3 - .0946)3}{2(2 - .0482)} \right] B + \left[1.5 - \frac{(3 - .0482)3}{2(2 - .0482)} \right] A = -Q_B$$

$$5.26B - .77A = -Q_B$$

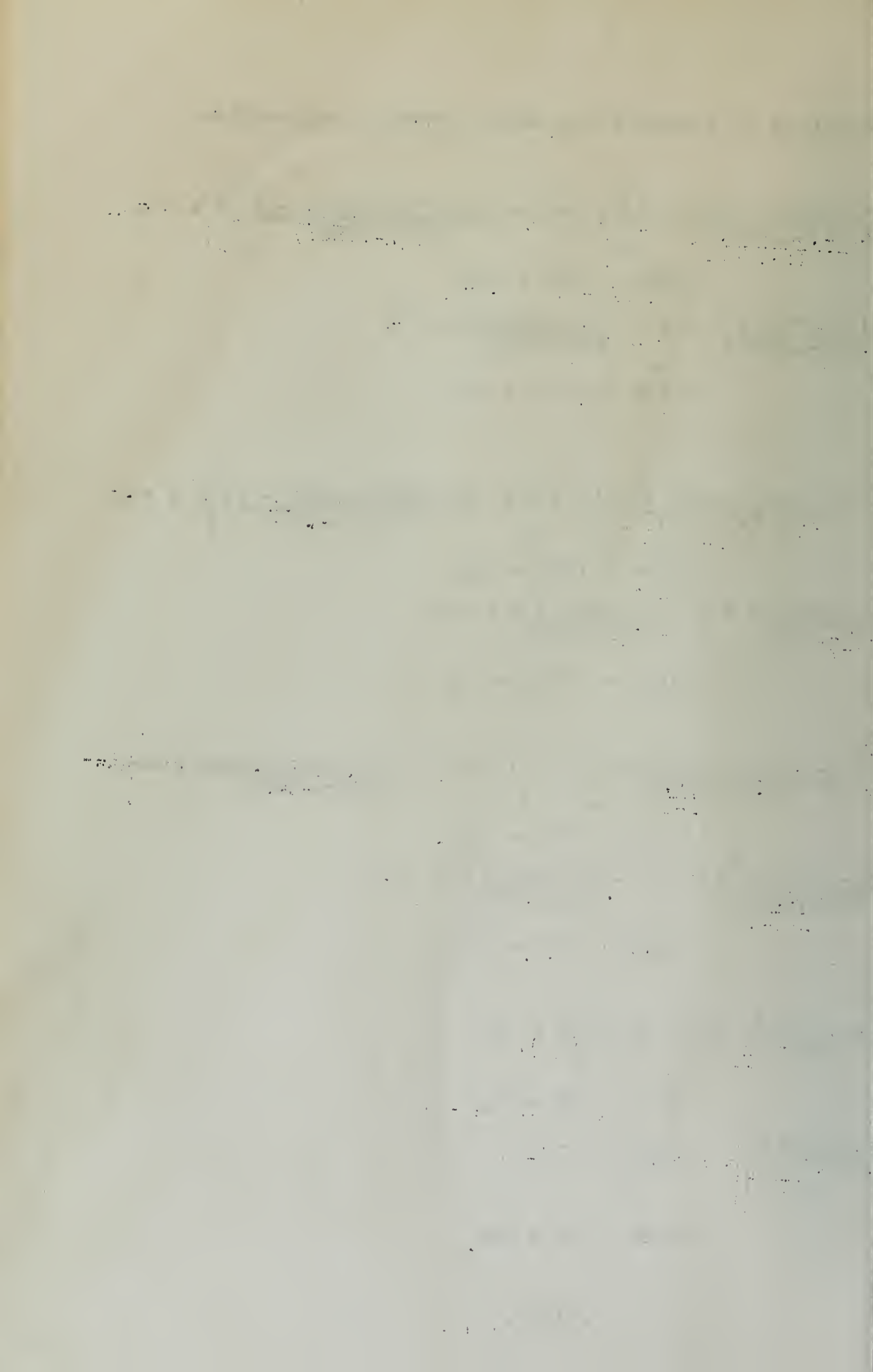
nel 4

$$4.5 + 2 + \left[\frac{3(-2)}{4} \right] A + \left[1 + \frac{3(-2)}{4} \right] B = -Q_A$$

$$5.0A - .5B = -Q_A$$

$$2 + 6 - \left[\frac{3(2)}{4} \right] B + \left[1 - \frac{3(2)}{4} \right] A = -Q_B$$

$$6.5B - .5A = -Q_B$$



Panel 5

$$\left[1.5 \times 4 + \frac{2}{4} \right] E - \frac{2}{4} F = -Q_E$$

$$6.5E - 0.5F = -Q_E$$

$$\left[1.5 \times 3 + \frac{2}{4} \right] F - \frac{2}{4} E = -Q_F$$

$$5.0F - 0.5E = -Q_F$$

Panel 6

$$\left[3 + 1.5 \times 3 - \frac{(3-2 \times .0482)3}{2(2-.0482)} \right] F + \left[\frac{3}{2} - \frac{(3-.0482)(3)}{2(2-.0482)} \right] G = -Q_F$$

$$5.26F - 0.77G = -Q_F$$

$$\left[2 + 3 + \frac{(3-.0482)(.0507 \times 2 - 3)}{2(2-.0482)} \right] G + \left[\frac{3}{2} + \frac{(3-2 \times .0482)(.0507 \times 2 - 3)}{2(2-.0482)} \right] F = -Q_G$$

$$3.81G - 0.65F = -Q_G$$

Panel 7

$$\left[4 + 1.5 \times 2 - \frac{(3-2 \times .0443)4}{2(2-.0443)} \right] G + \left[\frac{4}{2} - \frac{(3-.0443)4}{2(2-.0443)} \right] H = -Q_G$$

$$4.03G - 1.02H = -Q_G$$

$$\left[1 + 4 + \frac{(3-.0443)(.0463 \times 1 - 4)}{2(2-.0443)} \right] H + \left[\frac{4}{2} + \frac{(3-2 \times .0443)(.0463 \times 1 - 4)}{2(2-.0443)} \right] G = -Q_H$$

$$2.52H - 0.93G = -Q_H$$

Panel 8

$$\left[4 + 1.5 \times 1 - \frac{(3-2 \times .0866)4}{2(2-.0866)} \right] F + \left[\frac{4}{2} - \frac{(3-.0866)4}{2(2-.0866)} \right] I = -Q_H$$

$$2.54H - 1.040 = -Q_H$$

$$\left[.5 \times 1 + 4 + \frac{(3-.0866)(.0942 \times 1 - 4)}{2(2-.0866)} \right] I + \left[\frac{4}{2} - \frac{(3-2 \times .0866)(.0942 \times 1 - 4)}{2(2-.0866)} \right] H = -Q_I$$

$$2.52I - 0.90 = -Q_I$$

$$-\frac{1}{2} \left(\frac{1}{1-x} \right) = -\frac{1}{2} \sum_{n=0}^{\infty} x^n$$

$$12 \cdot \frac{1}{2} = 6$$

$$(12 \cdot \frac{1}{2}) \cdot \frac{1}{2} = 3$$

Joint Constant Computation - Load at B

Panel 1

$$2.52A - .90B = 6.14$$

$$-1.04A + 2.54B = 6.28$$

$$A = 3.89 \quad B = 4.07$$

$$R_1 = \frac{2.91 \times 3.89 + 2.83 \times 4.07}{3.82} + 1.57 = 7.45$$

$$M_{AB} = 4(3.89 + \frac{4.07}{2} - 7.45) = -6.12$$

$$M_{BA} = 4(4.07 + \frac{3.89}{2} - 7.45) = -5.80$$

Panel 2

$$2.52B - .93C = -1.20$$

$$-1.02B + 4.03C = -1.21$$

$$B = -.65 \quad C = -.46$$

$$R_2 = \frac{-2.96 \times .65 - 2.91 \times .46}{3.92} - .30 = -1.13$$

$$M_{BC} = 4(-.65 - \frac{.46}{2} + 1.13) = 1.00$$

$$M_{CB} = 4(-.46 - \frac{.65}{2} + 1.13) = 1.40$$

Panel 3

$$3.81C - .65D = -1.16$$

$$-.77C + 5.25D = -1.19$$

$$C = -.35 \quad D = -.28$$

$$R_3 = \frac{-2.95 \times .35 - 2.90 \times .28}{3.90} - .40 = -.87$$

$$M_{CD} = 3(-.35 - \frac{.28}{2} + .87) = 1.14$$

$$M_{DC} = 3(-.28 - \frac{.35}{2} + .87) = 1.26$$

Panel 4

$$5.0D - .5E = -.94$$

$$-.5D + 6.5E = -.94$$

$$D = -.20 \quad E = -.16$$

$$R_4 = 3/4(-.20 - .16) + .47 = -.74$$

$$M_{DE} = 2(-.20 - \frac{.16}{2} + .74) = .92$$

$$M_{ED} = 2(-.16 - \frac{.20}{2} + .74) = .96$$

anel 5

$$6.5E - 0.5F = -0.94$$

$$-0.5E + 5.0F = -0.94$$

$$E = -0.16$$

$$F = -0.20$$

$$R_5 = \frac{3}{4}(-.20 - .16) - 0.47 = -.74$$

$$M_{EF} = 2(-.16 - \frac{.20}{2} + .74) = .96$$

$$M_{FE} = 2(-.20 - \frac{.16}{2} + .74) = .92$$

anel 6

$$5.26F - 0.77G = -0.82$$

$$-0.65F + 3.81G = -0.79$$

$$F = -0.19 \quad G = -0.24$$

$$R_6 = \frac{-2.90 \times .19 - 2.95 \times .24}{3.90} - 0.27 = -0.59$$

$$M_{FG} = 3(-.19 - \frac{.24}{2} + .59) = .84$$

$$M_{GF} = 3(-.24 - .19 + .59) = .75$$

anel 7

$$4.03G - 1.02H = -0.87$$

$$-0.93G + 2.52H = -0.86$$

$$G = -0.33 \quad H = -0.46$$

$$R_7 = \frac{-2.91 \times .33 - 2.96 \times .46}{3.91} - 0.22 = -0.82$$

$$M_{GH} = 4(-.33 - \frac{.44}{2} + .82) = 1.04$$

$$M_{HG} = 4(-.46 - \frac{.33}{2} + .82) = .80$$

anel 8

$$2.54H - 1.04I = -0.90$$

$$-0.90H + 2.52I = -0.88$$

$$H = -0.58 \quad I = -0.56$$

$$R_8 = \frac{-2.83 \times 0.58 - 2.91 \times 0.56}{3.83} - .22 = -1.08$$

$$M_{HI} = 4(-.58 - \frac{.56}{2} + 1.08) = .88$$

$$M_{IH} = 4(-.56 - \frac{.58}{2} + 1.08) = .92$$

Load at C

Panel 1

$$\begin{aligned} 2.52A - .90B &= 5.27 \\ -1.04A + 2.54B &= 5.38 \end{aligned}$$

$$A = 3.33 \quad B = 3.48$$

$$R_1 = \frac{2.91 \times 3.33 + 2.83 \times 3.48}{3.82} + 1.35 = 6.47$$

$$M_{AB} = 4\left(3.33 + \frac{3.48}{2} - 6.47\right) = -5.88$$

$$M_{BA} = 4\left(3.48 + \frac{3.33}{2} - 6.47\right) = -5.32$$

Panel 2

$$\begin{aligned} 2.52B - .93C &= 5.17 \\ -1.02B + 4.03C &= 5.23 \end{aligned}$$

$$B = 2.79 \quad C = 2.0$$

$$R_2 = \frac{2.96 \times 2.79 + 2.91 \times 2.0}{3.92} + 1.31 = 4.90$$

$$M_{BC} = 4\left(2.79 + \frac{2.0}{2} - 4.90\right) = -4.44$$

$$M_{CB} = 4\left(2.0 + \frac{2.79}{2} - 4.90\right) = -6.04$$

Panel 3

$$\begin{aligned} 3.81C - .65D &= -2.31 \\ -.77C + 5.26D &= -2.33 \end{aligned}$$

$$C = -.70 \quad D = -.56$$

$$R_3 = \frac{-2.95 \times .70 - 2.90 \times .56}{3.90} - .79 = -1.74$$

$$M_{CD} = 3\left(-.70 - \frac{.56}{2} + 1.74\right) = 2.28$$

$$M_{DC} = 3\left(-.56 - \frac{.70}{2} + 1.74\right) = 2.49$$

Panel 4

$$5.0D - .5E = -1.87$$

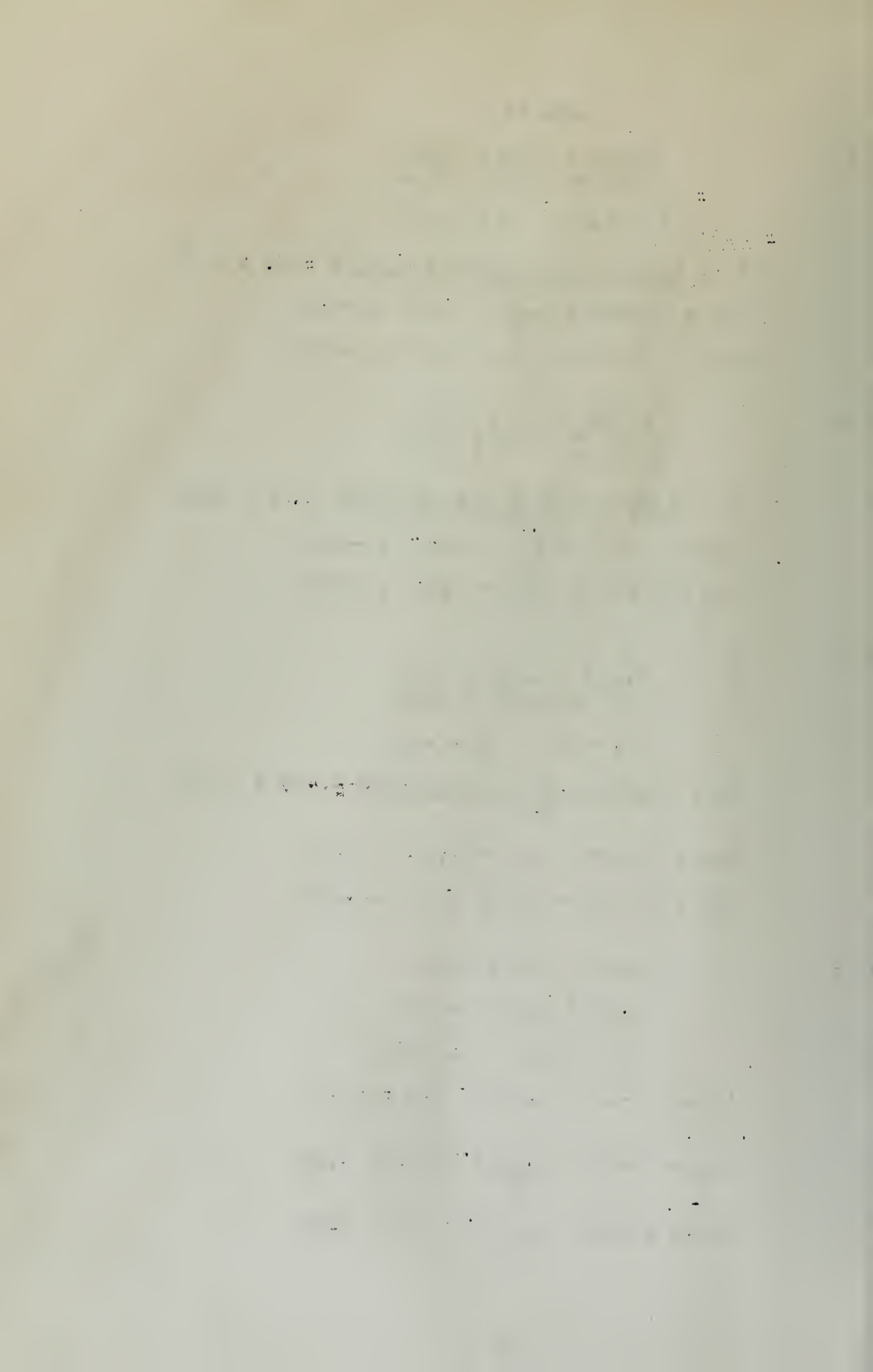
$$-.5D + 6.5E = -1.87$$

$$D = -.41 \quad E = -.32$$

$$R_4 = \frac{3}{4}(-.41 - .32) - .94 = -1.50$$

$$M_{DE} = 2\left(-.41 - \frac{.32}{2} + 1.50\right) = 1.86$$

$$M_{ED} = 2\left(-.32 - \frac{.41}{2} + 1.50\right) = 1.96$$



Panel 5

$$E = -0.32$$

$$F = -0.40$$

$$R_5 = -1.48$$

$$M_{EF} = 1.92$$

$$M_{FE} = 1.84$$

Panel 6

$$F = -0.73$$

$$G = -0.15$$

$$R_6 = -1.18$$

$$M_{FG} = 1.68$$

$$M_{GF} = 1.50$$

Panel 7

$$G = -0.86$$

$$H = -0.85$$

$$R_7 = -1.64$$

$$M_{GH} = 2.05$$

$$M_{HG} = 1.60$$

Panel 8

$$H = -1.16$$

$$I = -1.11$$

$$R_8 = -2.23$$

$$M_{HI} = 1.75$$

$$M_{IH} = 1.84$$

Load at D

$$\begin{aligned} 2.52A - .90B &= 4.38 \\ -1.04A + 2.54B &= 4.49 \end{aligned}$$

$$A = 2.79 \quad B = 2.91$$

$$R_1 = \frac{2.91 \times 2.79 + 2.83 \times 2.91}{3.82} - 1.12 = 5.40$$

$$M_{AB} = 4\left(2.79 + \frac{2.91}{2} - 5.40\right) = -4.64$$

$$M_{BA} = 4\left(2.91 + \frac{2.79}{2} - 5.40\right) = -4.40$$

Panel 2

$$\begin{aligned} 2.52B - .93C &= 4.31 \\ -1.02B + 4.03C &= 4.36 \end{aligned}$$

$$B = 2.33 \quad C = 1.66$$

$$R_2 = \frac{2.96 \times 2.33 + 2.91 \times 1.66}{3.92} - 1.09 = 4.09$$

$$M_{BC} = 4\left(2.33 + \frac{1.66}{2} - 4.09\right) = -3.72$$

$$M_{CB} = 4\left(1.66 + \frac{2.33}{2} - 4.09\right) = -5.08$$

Panel 3

$$\begin{aligned} 3.81C - .65D &= 3.98 \\ -.77C + 5.26D &= 4.12 \end{aligned}$$

$$C = 1.21 \quad D = .96$$

$$R_3 = \frac{2.95 \times 1.21 + 2.90 \times .96}{3.90} - 1.37 = 2.99$$

$$M_{CD} = 3\left(1.21 + \frac{.96}{2} - 2.99\right) = -3.90$$

$$M_{DC} = 3\left(.96 + \frac{1.21}{2} - 2.99\right) = -4.29$$

Panel 4

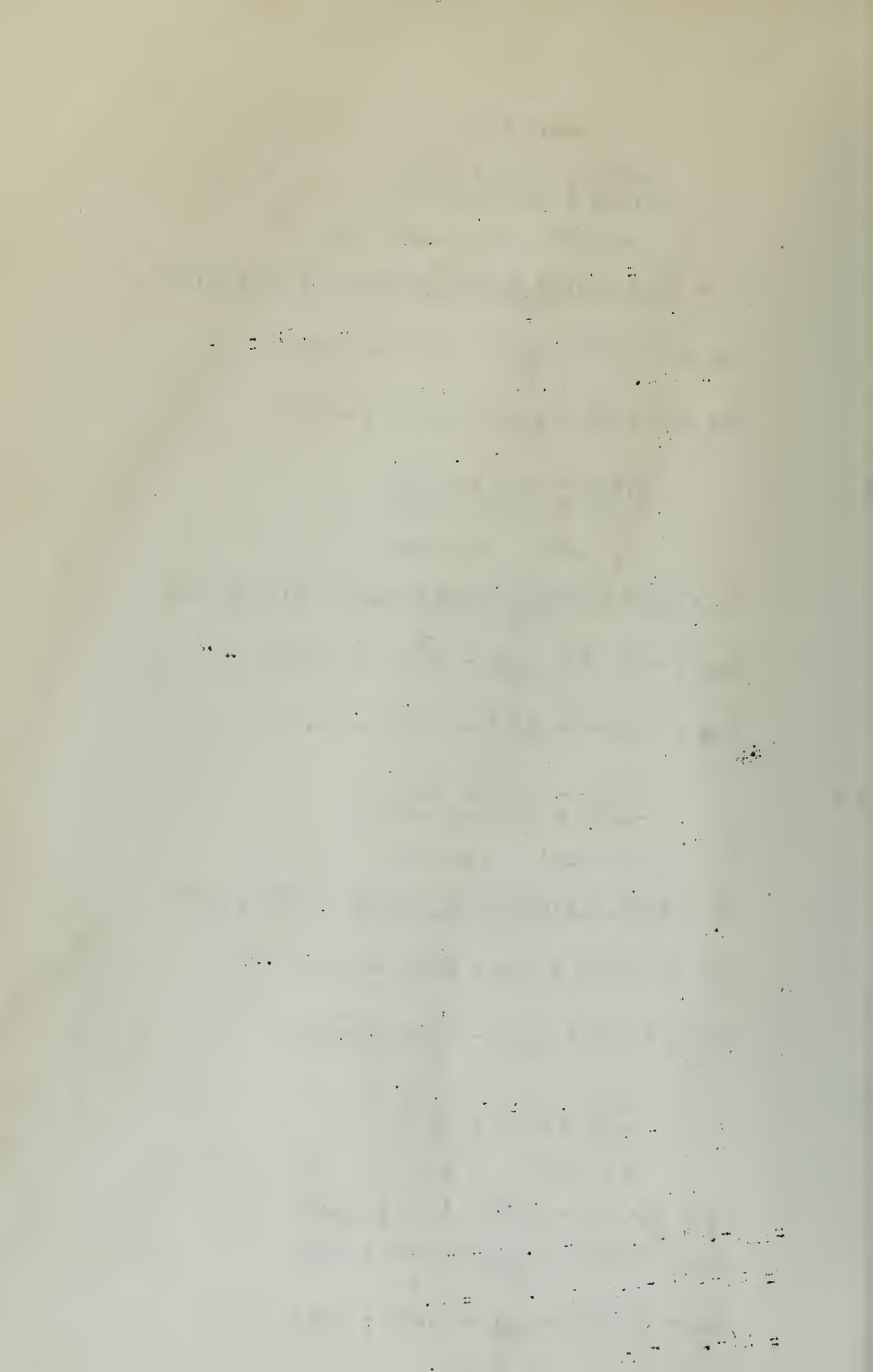
$$\begin{aligned} 5.0D - .5E &= -2.82 \\ -.5D + 6.5E &= -2.82 \end{aligned}$$

$$D = -.61 \quad E = -.48$$

$$R_4 = \frac{3(-.61 - .49)}{4} - 1.41 = -2.23$$

$$M_{DE} = 2\left(-.61 - \frac{.48}{2} + 2.23\right) = 2.76$$

$$M_{ED} = 2\left(-.48 - \frac{.61}{2} + 2.23\right) = 2.90$$



Panel 5

$$E = -0.48$$

$$F = -1.60$$

$$R_5 = -2.22$$

$$M_{EF} = 2.88$$

$$M_{FE} = 2.76$$

Panel 6

$$F = -0.57$$

$$G = -1.72$$

$$R_6 = -1.77$$

$$M_{FG} = 2.52$$

$$M_{GF} = 2.25$$

Panel 7

$$G = -0.99$$

$$H = -1.39$$

$$R_7 = -2.46$$

$$M_{GH} = 3.12$$

$$M_{HG} = 2.40$$

Panel 8

$$H = -1.74$$

$$I = -1.68$$

$$R_8 = -3.24$$

$$M_{HI} = 2.64$$

$$M_{IH} = 2.76$$

1. 1. 1.

2. 2. 2.

3. 3. 3.

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Load at E

Panel 1

$$2.52A - .91B = 3.51$$

$$-1.04A + 2.54B = 3.59$$

$$A = 2.22 \quad B = 2.33$$

$$R_1 = \frac{2.91 \times 2.22 + 2.83 \times 2.33}{3.82} + .90 = 4.32$$

$$M_{AB} = 4(2.22 + \frac{2.33}{2} - 4.32) = -3.76$$

$$M_{BA} = 4(2.33 + \frac{2.22}{2} - 4.32) = -3.52$$

Panel 2

$$2.52B - .93C = 3.44$$

$$-1.02B + 4.03C = 3.49$$

$$B = 1.86 \quad C = 1.33$$

$$R_2 = \frac{2.96 \times 1.86 + 2.91 \times 1.33}{3.92} + .87 = 3.26$$

$$M_{BC} = 4(1.86 + \frac{1.33}{2} - 3.26) = -2.96$$

$$M_{CB} = 4(2.33 + \frac{1.86}{2} - 3.26) = -4.00$$

Panel 3

$$3.81C - .65D = 3.18$$

$$-.77C + 5.26D = 3.30$$

$$C = .97 \quad D = .77$$

$$R_3 = \frac{2.95 \times .97 + 2.90 \times .77}{3.90} + 1.10 = 2.40$$

$$M_{CD} = 3(.97 + .77/2 - 2.40) = -3.15$$

$$M_{DC} = 3(.77 + .97/2 - 2.40) = -3.84$$

Panel 4

$$5.0D - .5E = 3.75$$

$$-.5D + 6.5E = 3.75$$

$$D = .82 \quad E = .64$$

$$R_4 = 3/4(.82 + .64) + 1.88 = 2.97$$

$$M_{DE} = 2(.82 + .64/2 - 2.97) = -3.66$$

$$M_{ED} = 2(.64 + .82/2 - 2.97) = -3.84$$

Panel 5

$$E = -0.64$$

$$F = -0.80$$

$$R_5 = -2.96$$

$$M_{EF} = 3.84$$

$$M_{FE} = 3.68$$

Panel 6

$$F = -0.76$$

$$G = -0.96$$

$$R_6 = -2.36$$

$$M_{FG} = 3.36$$

$$M_{GF} = 3.00$$

Panel 7

$$G = -1.32$$

$$H = -1.84$$

$$R_7 = -3.28$$

$$M_{GH} = 4.16$$

$$M_{HG} = 3.20$$

Panel 8

$$H = -2.32$$

$$I = -2.24$$

$$R_8 = -4.32$$

$$M_{HI} = 3.52$$

$$M_{IH} = 3.68$$

First Moment Corrections - Load at B

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -1.00$$

$$A = -.16 \quad B = -.46$$

$$R_1 = \frac{-2.91 \times .16 - 2.83 \times .46}{3.83} = -0.46$$

$$M_{AB} = 4(-.16 - .46/2 + .46) = .28$$

$$M_{BA} = 4(-.46 - .16/2 + .46) = -.32$$

Panel 2

$$2.52B - .93C = 5.80$$

$$-1.02B + 4.03C = -1.14$$

$$B = 2.42 \quad C = .33$$

$$R_2 = \frac{2.90 \times 2.42 + 2.91 \times .33}{3.81} = 2.07$$

$$M_{BC} = 4(2.42 + .33/2 - 2.07) = 2.04$$

$$M_{CB} = 4(.33 + 2.42/2 - 2.07) = -2.16$$

Panel 3

$$3.81C - .65D = -1.40$$

$$-.77C + 5.26D = -.92$$

$$C = -.40 \quad D = -.23$$

$$R_3 = \frac{-2.95 \times .40 - 2.90 \times .23}{3.80} = -.47$$

$$M_{CD} = 3(-.40 - .23/2 + .47) = -.12$$

$$M_{DC} = 3(-.23 - .40/2 + .47) = .12$$

Panel 4

$$6.5D - 0.5E = -1.26$$

$$-0.5D + 5.0E = -.96$$

$$D = -.22 \quad E = -.21$$

$$R_4 = 3/4(-.22 - .21) = -.32$$

$$M_{DE} = 2(-.22 - .21/2 + .32) = 0$$

$$M_{ED} = 2(-.21 - .22/2 + .32) = 0$$

Panel 5

$$5.0E - 0.5F = -.96$$

$$-0.5 + 6.5F = -.84$$

$$E = -.21, F = -.14$$

$$R_5 = \frac{3}{2} (-.21 - .14) = -.26$$

$$M_{EF} = 2(-.21 - \frac{.14}{2} + .26) = -.04$$

$$M_{FE} = 2(-.14 - \frac{.21}{2} + .26) = .04$$

Panel 6

$$5.26F + 0.77G = -.92$$

$$-0.65F + 3.81G = -1.04$$

$$F = -.22, G = -.31$$

$$R_6 = \frac{-2.90 \times .22 - 2.95 \times .31}{3.90} = .40$$

$$M_{FG} = 3(-.22 - \frac{.31}{2} + .40) = .06$$

$$M_{GF} = 3(-.31 - \frac{.22}{2} + .40) = -.06$$

Panel 7

$$4.03G + 1.02H = -.75$$

$$-0.93G + 2.52H = -.88$$

$$G = -.30, H = -.46$$

$$R_7 = \frac{-2.91 \times .30 - 2.96 \times .46}{3.91} = -.57$$

$$M_{GH} = 4(-.30 - \frac{.46}{2} + .57) = .16$$

$$M_{HG} = 4(-.46 - \frac{.30}{2} + .57) = -.16$$

Panel 8

$$2.54H + 1.04I = -.60$$

$$-0.94H + 2.52I = 0$$

$$H = -.37, I = -.13$$

$$R_8 = \frac{-2.33 \times .37 - 2.91 \times .13}{3.83} = -.37$$

$$M_{HI} = 4(-.37 - \frac{.13}{2} + .37) = -.24$$

$$M_{IH} = 4(-.13 - \frac{.37}{2} + .37) = .24$$

Second Moment Corrections-Load at B

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -2.04$$

$$A = -.34, B = -.94$$

$$R_1 = \frac{-2.91 \times .34 - 2.83 \times .94}{3.83} = -.95$$

$$M_{AB} = 4(-.34 - \frac{.94}{2} + .95) = .56$$

$$M_{BA} = 4(-.94 - \frac{.34}{2} + .95) = -.64$$

Panel 3

$$3.81C - .65D = -2.18$$

$$-.77C + 5.26D = 0$$

$$C = -.58, D = -.08$$

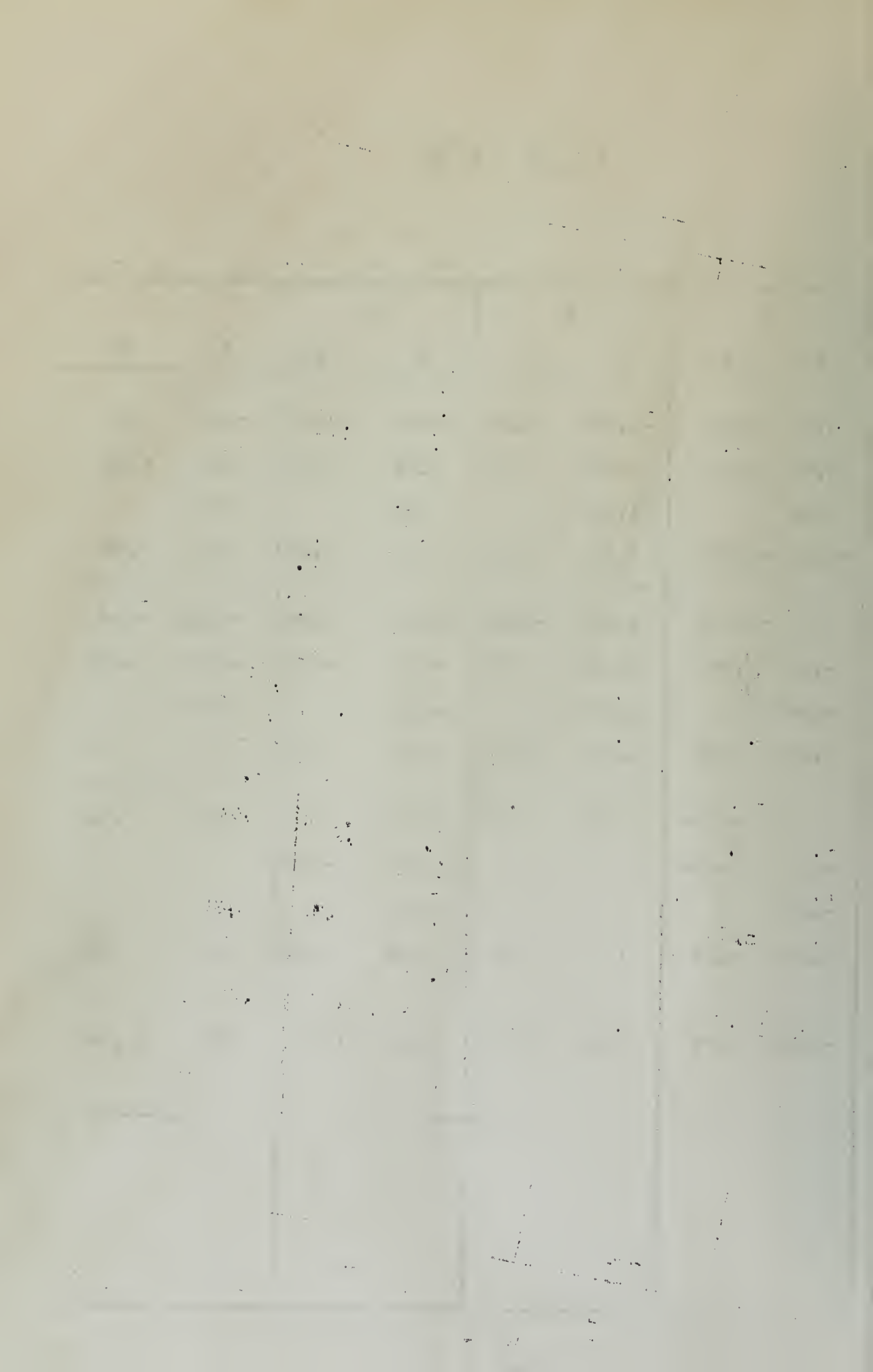
$$R_3 = \frac{-2.95 \times .58 - 2.90 \times .08}{3.90} = -.50$$

$$M_{CD} = 3(-.58 - \frac{.08}{2} + .50) = -.36$$

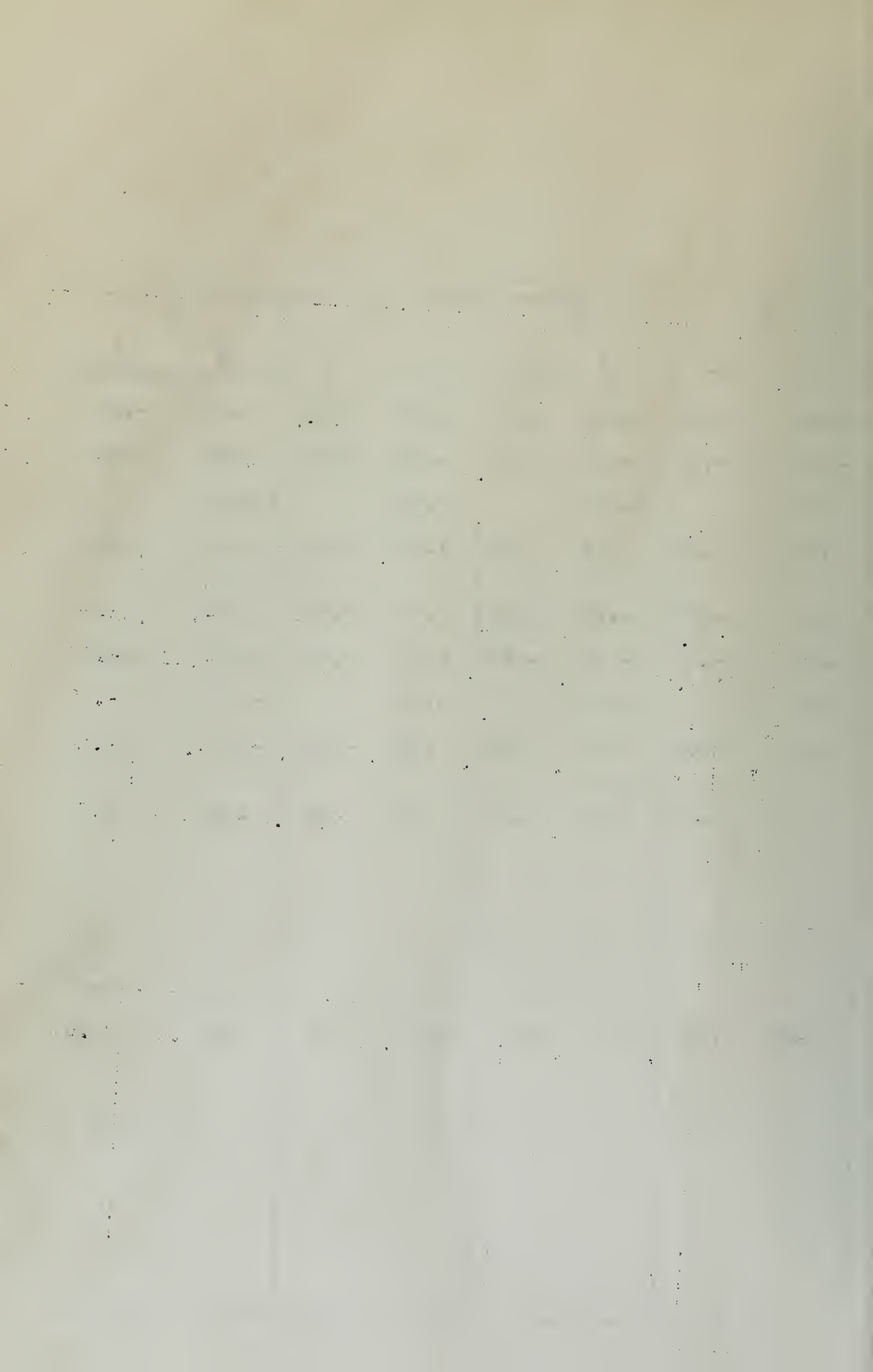
$$M_{DC} = 3(-.08 - \frac{.58}{2} + .50) = .39$$

Load at B

| anel | 1 | | 2 | | 3 | | 4 | |
|-------|-------|-------|-------|-------|-------|-------|-------|------|
| oint | A | B | B | C | C | D | D | E |
| Q | 6.14 | 6.28 | -1.20 | -1.21 | -1.16 | -1.19 | -.94 | -.94 |
| C | 3.89 | 4.07 | -.65 | -.46 | -.35 | -.28 | -.20 | -.16 |
| R | 7.45 | | -1.13 | | -.87 | | -.74 | |
| E' | -6.12 | -5.80 | 1.00 | 1.40 | 1.14 | 1.26 | .92 | .96 |
| Q | 0 | -1.00 | 5.80 | -1.14 | -1.40 | -.92 | -1.26 | -.98 |
| C | -.16 | -.46 | 2.42 | .32 | -.40 | -.23 | -.22 | -.21 |
| R | -.46 | | 2.07 | | -.47 | | -.32 | |
| E'' | .28 | -.32 | 2.04 | -2.16 | -.12 | .12 | 0 | 0 |
| Q | 0 | -2.04 | .32 | .12 | -2.16 | 0 | -.12 | .04 |
| C | -.34 | -.94 | | | -.58 | -.08 | | |
| R | -.95 | | | | -.50 | | | |
| E''' | .56 | -.64 | 0 | 0 | -.36 | .39 | .0 | .00 |
| E'''' | -5.28 | -6.76 | 3.04 | -0.76 | .66 | 1.77 | .92 | .96 |



| Panel
Point | 5 | | 6 | | 7 | | 8 | |
|----------------|------|------|------|-------|------|------|-------|------|
| | E | F | F | G | G | H | H | I |
| Q | -.94 | -.94 | -.82 | -.79 | -.87 | -.86 | -.90 | -.88 |
| X | -.16 | -.20 | -.19 | -.24 | -.33 | -.46 | -.58 | -.56 |
| R | -.74 | | -.59 | | -.82 | | -1.08 | |
| H' | .96 | .92 | .34 | .75 | 1.04 | .80 | .88 | .92 |
| Q | -.96 | -.84 | -.92 | -1.04 | -.75 | -.88 | -.80 | 0 |
| C | -.21 | -.14 | -.22 | -.31 | -.50 | -.46 | -.37 | -.13 |
| R | -.26 | | -.40 | | -.57 | | -.37 | |
| H'' | -.04 | -.04 | .06 | -.06 | .16 | -.16 | -.24 | .24 |
| Q | 0 | -.06 | -.04 | .16 | .06 | .24 | .16 | 0 |
| C | | | | | | | | |
| R | | | | | | | | |
| H''' | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H | .92 | .96 | .90 | .69 | 1.20 | .64 | .64 | 1.16 |
| | | | | | | | | |
| | | | | | | | | |



First Moment Corrections - Load at C

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = 4.44$$

$$A = .73 \quad B = 2.05$$

$$R_1 = \frac{2.91 \times .73 + 2.83 \times 2.05}{3.83} = 2.06$$

$$M_{AB} = 4(.73 + 2.05/2 - 2.06) = -1.24$$

$$M_{BA} = 4(2.05 + .73/2 - 2.06) = 1.40$$

Panel 2

$$2.52B - .93C = 5.32$$

$$-1.02B + 4.03C = -2.28$$

$$B = 2.10 \quad C = -.04$$

$$R_2 = \frac{2.93 \times 2.10 + 2.91 \times .04}{3.91} = 1.60$$

$$M_{BC} = 4(2.10 + .04/2 - 1.60) = 1.92$$

$$M_{CB} = 4(-.04 + 2.10/2 - 1.60) = -2.04$$

Panel 3

$$3.81C - 0.65D = 6.04$$

$$-0.77C + 5.26D = -1.86$$

$$C = 1.56 \quad D = -.12$$

$$R_3 = \frac{2.95 \times 1.56 + 2.90 \times .12}{3.90} = 1.09$$

$$M_{CD} = 3(1.56 + .12/2 - 1.09) = 1.23$$

$$M_{DC} = 3(-.12 + 1.56/2 - 1.09) = -1.29$$

Panel 4

$$6.5D - 0.5E = -2.49$$

$$-0.5D + 5.0E = -1.92$$

$$D = -.42 \quad E = -.42$$

$$R_4 = 3/4(-.42 - .42) = -.63$$

$$M_{DE} = 2(-.42 - .42/2 + .63) = 0$$

$$M_{ED} = 2(-.42 - .42/2 + .63) = 0$$

Panel 5 $5.0E - 0.5F = -1.96$

$$-0.5E + 6.5F = -1.63$$

$$E = -.42 \quad F = -.29$$

$$R_5 = 3/4(-.42 - .29) = -.53$$

$$M_{EF} = 2(-.42 - .29/2 + .53) = -.06$$

$$M_{FE} = 2(-.29 - .42/2 + .53) = .06$$

Panel 6 $5.26F - 0.77G = -1.84$

$$-0.65F + 3.81G = -2.08$$

$$F = -.44 \quad G = -.62$$

$$R_6 = \frac{-2.90 \times .44 - 2.95 \times .62}{3.96} = -.80$$

$$M_{FG} = 3(-.44 - .62/2 + .80) = .15$$

$$M_{GF} = 3(-.29 - .44/2 + .80) = -.12$$

Panel 7 $4.03G - 1.02H = -1.50$

$$-0.93G + 2.52H = -1.76$$

$$G = -.60 \quad H = -.92$$

$$R_7 = \frac{-2.91 \times .60 - 2.96 \times .92}{3.91} = -1.14$$

$$M_{GH} = 4(-.60 - .92/2 + 1.14) = .32$$

$$M_{HG} = 4(-.92 - .60/2 + 1.14) = -.32$$

Panel 8 $2.54H - 1.04I = -1.60$

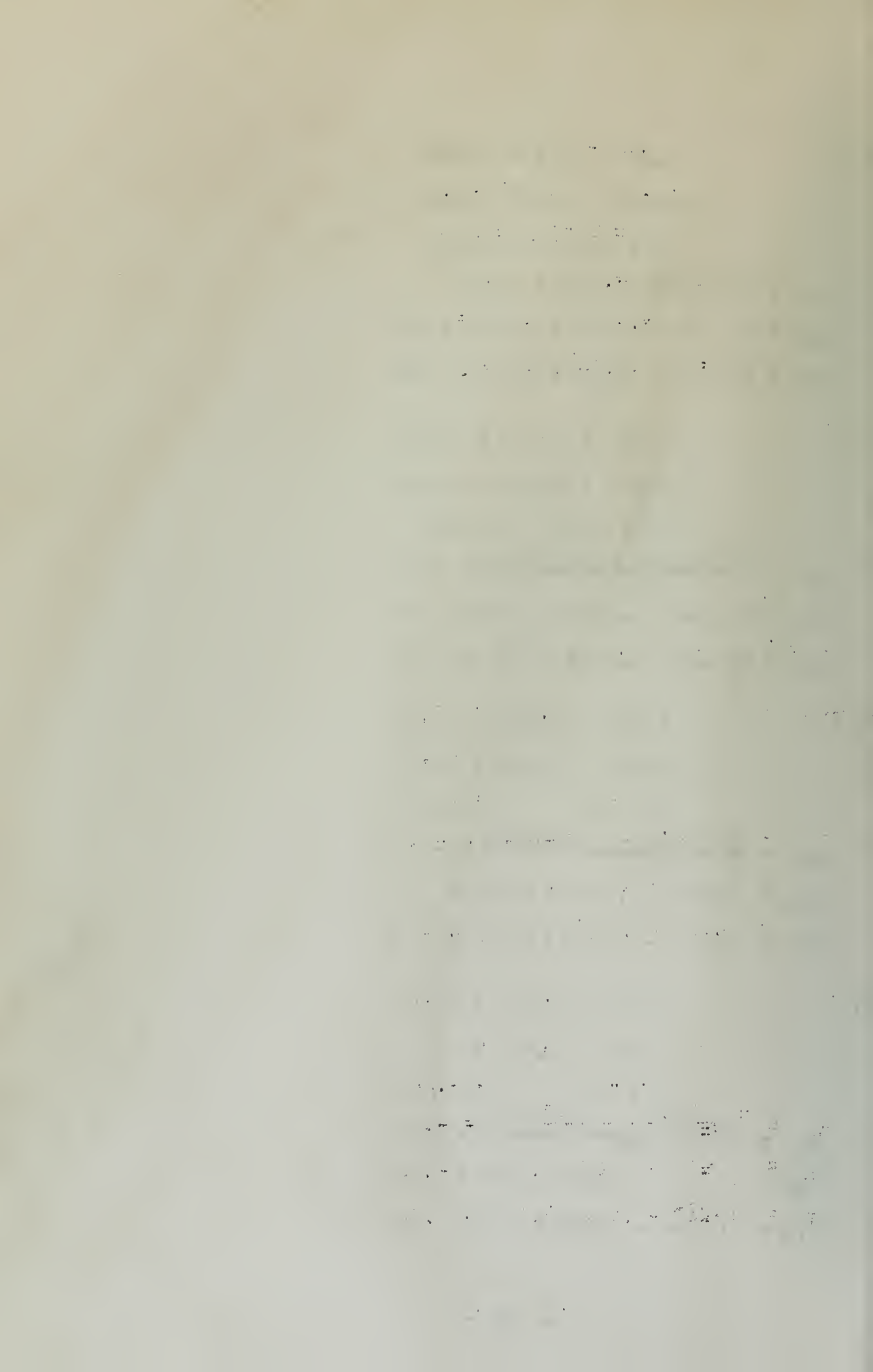
$$-0.90H + 2.52I = 0$$

$$H = -.74 \quad I = -.26$$

$$R_8 = \frac{-2.83 \times .74 - 2.91 \times .26}{3.83} = -.74$$

$$M_{HI} = 4(-.74 - .26/2 + .74) = -.52$$

$$M_{IH} = 4(-.26 - .74/2 + .74) = .44$$



Second Moment Corrections - Load at C

Panel 1

$$2.52A - 0.90B = 0$$

$$-1.04A + 2.54B = -1.92$$

$$A = -.32 \quad B = -.88$$

$$R_1 = \frac{-2.91 \times .32 - 2.83 \times .88}{3.83} = -.89$$

$$M_{AB} = 4(-.32 - .88/2 + .89) = .52$$

$$M_{BA} = 4(-.88 - .32/2 + .89) = -.60$$

Panel 2

$$2.52B - 0.93C = -1.40$$

$$-1.02B + 4.03C = -1.23$$

$$B = -.74 \quad C = -.49$$

$$R_2 = \frac{-2.96 \times .74 - 2.91 \times .49}{3.91} = -.93$$

$$M_{BC} = 4(-.74 - .49/2 + .93) = -.24$$

$$M_{CB} = 4(-.49 - .74/2 + .93) = .28$$

Panel 3

$$3.81C - 0.65D = 2.04$$

$$-0.77C + 5.28D = 0$$

$$C = .55 \quad D = .08$$

$$R_3 = \frac{2.95 \times .55 + 2.90 \times .08}{3.90} = .47$$

$$M_{CD} = 3(.55 + .08/2 - .47) = .36$$

$$M_{DC} = 3(.08 + .55/2 - .47) = -.36$$

Panel 4

$$6.5D - 0.5E = 1.29$$

$$-0.5D + 5.0E = .06$$

$$D = .20 \quad E = .03$$

$$R_4 = 2/4(.20 + .03) = .17$$

$$M_{DE} = 2(.20 + .03/2 - .17) = .08$$

$$M_{ED} = 2(.03 + .20/2 - .17) = -.08$$

nel 5

$$5.0E - 0.5F = 0$$

$$-0.5E + 6.5F = -.15$$

$$E = 0 \quad F = -.02$$

$$R_5 = 3/4(-.02) = -.02$$

$$M_{EF} = 0$$

$$M_{FE} = 0$$

nel 6

$$5.26F - 0.77G = -.06$$

$$-0.65F + 3.81G = -.32$$

$$F = -.02 \quad G = -.08$$

$$R_6 = \frac{-2.90x.02 - 2.95x.08}{3.90} = -.07$$

$$M_{FG} = 3(-.02 - .08/2 + .07) = .03$$

$$M_{GF} = 3(-.08 - .02/2 + .07) = -.06$$

nel 7

$$4.03G - 1.02H = .12$$

$$-0.93G + 2.52H = .52$$

$$G = .09 \quad H = .24$$

$$R_7 = \frac{2.91x.09 + 2.96x.24}{3.91} = .25$$

$$M_{GH} = 4(.09 + .24/2 - .25) = -.16$$

$$M_{HG} = 4(.24 + .09/2 - .25) = .16$$

nel 8

$$2.54H - 1.04I = .32$$

$$-0.90H - 2.52I = 0$$

$$H = .15 \quad I = .05$$

$$R_8 = \frac{2.83x.15 + 2.91x.05}{3.83} = .15$$

$$M_{HI} = 4(.15 + .05/2 - .15) = .10$$

$$M_{IH} = 4(.05 + .15/2 - .15) = -.10$$

Load at C

| Panel | 1 | | 2 | | 3 | | 4 | |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|
| Joint | A | B | B | C | C | D | D | E |
| Q | 5.27 | 5.33 | 5.17 | 5.23 | -2.31 | -2.38 | -1.87 | -1.87 |
| α | 3.33 | 3.48 | 2.79 | 2.00 | - .70 | - .56 | - .41 | - .32 |
| R | 6.47 | | 4.90 | | -1.74 | | -1.50 | |
| M | -5.88 | -5.32 | -4.44 | -6.04 | 2.28 | 2.49 | 1.86 | 1.96 |
| Q | 0 | 4.44 | 5.32 | -2.28 | 6.04 | -1.86 | -2.49 | -1.92 |
| α | .73 | 2.05 | 2.10 | - .04 | 1.56 | - .12 | - .42 | - .42 |
| R | 2.06 | | 1.60 | | 1.09 | | - .63 | |
| M' | -1.24 | 1.40 | 1.92 | -2.04 | 1.23 | -1.29 | 0 | 0 |
| Q | 0 | -1.92 | -1.40 | -1.23 | 2.04 | 0 | 1.29 | .06 |
| | - .32 | - .88 | - .74 | - .49 | .55 | .08 | .20 | .03 |
| R | - .89 | | - .93 | | .47 | | .17 | |
| M'' | .52 | - .60 | - .24 | .28 | .36 | - .36 | .08 | - .08 |
| H | -6.60 | -4.52 | -3.76 | -7.80 | 3.87 | .84 | 1.94 | 1.88 |

1. The first part of the document is a list of names and addresses, which are arranged in a columnar fashion. The names are written in a cursive script, and the addresses are written in a more formal, printed style. The list appears to be a directory or a roster of some kind.

2. The second part of the document is a series of short, handwritten notes or entries. These are arranged in a columnar fashion, similar to the first part. The notes are written in a cursive script, and they appear to be related to the names and addresses listed in the first part.

3. The third part of the document is a series of short, handwritten notes or entries. These are arranged in a columnar fashion, similar to the first part. The notes are written in a cursive script, and they appear to be related to the names and addresses listed in the first part.

4. The fourth part of the document is a series of short, handwritten notes or entries. These are arranged in a columnar fashion, similar to the first part. The notes are written in a cursive script, and they appear to be related to the names and addresses listed in the first part.

5. The fifth part of the document is a series of short, handwritten notes or entries. These are arranged in a columnar fashion, similar to the first part. The notes are written in a cursive script, and they appear to be related to the names and addresses listed in the first part.

6. The sixth part of the document is a series of short, handwritten notes or entries. These are arranged in a columnar fashion, similar to the first part. The notes are written in a cursive script, and they appear to be related to the names and addresses listed in the first part.

7. The seventh part of the document is a series of short, handwritten notes or entries. These are arranged in a columnar fashion, similar to the first part. The notes are written in a cursive script, and they appear to be related to the names and addresses listed in the first part.

8. The eighth part of the document is a series of short, handwritten notes or entries. These are arranged in a columnar fashion, similar to the first part. The notes are written in a cursive script, and they appear to be related to the names and addresses listed in the first part.

9. The ninth part of the document is a series of short, handwritten notes or entries. These are arranged in a columnar fashion, similar to the first part. The notes are written in a cursive script, and they appear to be related to the names and addresses listed in the first part.

10. The tenth part of the document is a series of short, handwritten notes or entries. These are arranged in a columnar fashion, similar to the first part. The notes are written in a cursive script, and they appear to be related to the names and addresses listed in the first part.

| 5 | | 6 | | 7 | | 8 | |
|------|-------|-------|-------|-------|-------|-------|-------|
| E | F | F | G | G | H | H | I |
| 1.88 | -1.88 | -1.64 | -1.58 | -1.74 | -1.72 | -1.80 | -1.76 |
| .32 | - .40 | - .38 | - .48 | - .66 | - .93 | -1.16 | -1.12 |
| 1.48 | | -1.16 | | -1.64 | | -2.16 | |
| 1.92 | 1.84 | 1.68 | 1.50 | 2.08 | 1.60 | 1.76 | 1.84 |
| 1.96 | -1.68 | -1.84 | -2.08 | -1.50 | -1.76 | -1.60 | 0 |
| .42 | - .29 | - .44 | - .62 | - .60 | - .92 | - .74 | - .26 |
| .53 | | - .80 | | -1.14 | | - .74 | |
| .06 | .06 | .15 | - .12 | .32 | - .32 | - .52 | .44 |
| 0 | - .15 | - .06 | - .32 | .12 | .52 | .32 | 0 |
| 0 | - .02 | - .02 | - .08 | .09 | .24 | .15 | .05 |
| .02 | | - .07 | | .25 | | .15 | |
| 0 | 0 | .03 | - .06 | - .16 | .16 | .10 | - .10 |
| 1.86 | 1.90 | 1.86 | 1.32 | 2.24 | 1.44 | 1.34 | 2.28 |

1. The first part of the paper discusses the importance of the study of the history of the United States. It is a very important part of the study of the United States and its people. The study of the history of the United States is a very important part of the study of the United States and its people.

2. The second part of the paper discusses the importance of the study of the history of the United States. It is a very important part of the study of the United States and its people. The study of the history of the United States is a very important part of the study of the United States and its people.

3. The third part of the paper discusses the importance of the study of the history of the United States. It is a very important part of the study of the United States and its people. The study of the history of the United States is a very important part of the study of the United States and its people.

Panel 5

$$-.5F + 6.5E = -2.90$$

$$5.0F - .5E = -2.52$$

$$E = -.49, F = -.55, R_5 = -1.70$$

$$I_{FE} = 2(-.49 - .55/2 + 1.70) = .04$$

$$I_{EF} = 2(-.55 - .49/2 + 1.70) = -1.02$$

Panel 6

$$-.77G + 5.26F = -2.76$$

$$3.01G - .65F = -3.12$$

$$F = -.66, G = -.93, R_6 = -1.20$$

$$I_{FG} = 3(-.66 - .93/2 + 1.20) = .21$$

$$I_{GF} = 3(-.93 - .66/2 + 1.20) = -.18$$

Panel 7

$$-1.02H + 4.03G = -2.25$$

$$2.52H - .93G = -2.64$$

$$G = -.91, H = -1.30, R_7 = -1.71$$

$$I_{GH} = 4(-.91 - 1.30/2 + 1.71) = .44$$

$$I_{HG} = 4(-1.30 - .91/2 + 1.71) = -.48$$

Panel 8

$$-1.04I + 2.54H = -2.40$$

$$2.52I - .90H = 0$$

$$H = -1.11, I = -.39, R_8 = -1.12$$

$$I_{HI} = 4(-1.11 - .39/2 + 1.12) = -.72$$

$$I_{IH} = 4(-.39 - 1.11/2 + 1.12) = .72$$

Influence Line Corrections - Second Set - Load at D

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -.80$$

$$A = -.13, B = -.37, R_1 = -.37$$

$$M_{AB} = 4(-.13 - .37/2 + .37) = .24$$

$$M_{BA} = 4(-.37 - .13/2 + .37) = -.24$$

Panel 2

$$2.52B - .93C = -1.08$$

$$-1.02B + 4.03C = -1.17$$

$$B = -.59, C = -.44, R_2 = -.77$$

$$M_{BC} = 4(-.59 - .44/2 + .77) = -.16$$

$$M_{CB} = 4(-.44 - .59/2 + .77) = .16$$

Panel 3

$$3.81C - .65D = .76$$

$$-.77C + 5.26D = +1.60$$

$$C = .18, D = -.09, R_3 = .08$$

$$M_{CD} = 3(.18 - .09/2 - .08) = .18$$

$$M_{DC} = 3(-.09 + .18/2 - .08) = -.24$$

Panel 4

$$5.0D - .5E = 1.26$$

$$-.5D + 6.5E = -.04$$

$$D = .25, E = .01, R_4 = .20$$

$$M_{DE} = 2(.25 + .01/2 - .20) = .10$$

$$M_{ED} = 2(.01 + .25/2 - .20) = -.14$$

Panel 5

$$-.5F + 6.5E = .60$$

$$5.0F - .5E = -.21$$

$$E = .09, F = -.03, R_5 = .04$$

$$M_{EF} = 2(.09 - .03/2 - .04) = .08$$

$$M_{FE} = 2(-.03 + .09/2 - .04) = -.06$$

Panel 6

$$-.77G + 5.26F = .02$$

$$3.81G - .65F = -.44$$

$$F = -.01, G = -.12, R_6 = -.10$$

$$M_{FG} = 3(-.01 - .12/2 + .10) = .09$$

$$M_{GF} = 3(-.12 - .01/2 + .10) = -.09$$

Panel 7

$$-1.02H + 4.03G = .18$$

$$2.52H - .93G = .72$$

$$G = .13, H = .33, R_7 = .35$$

$$M_{GH} = 4(.13 + .33/2 - .35) = -.24$$

$$M_{HG} = 4(.33 + .13/2 - .35) = .20$$

Panel 8

$$-1.04I + 2.54H = .48$$

$$2.52I - .90H = 0$$

$$H = .22, I = .08, R_8 = .22$$

$$M_{HI} = 4(.22 + .08/2 - .22) = .16$$

$$M_{IH} = 4(.08 + .22/2 - .22) = -.12$$

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

RECEIVED

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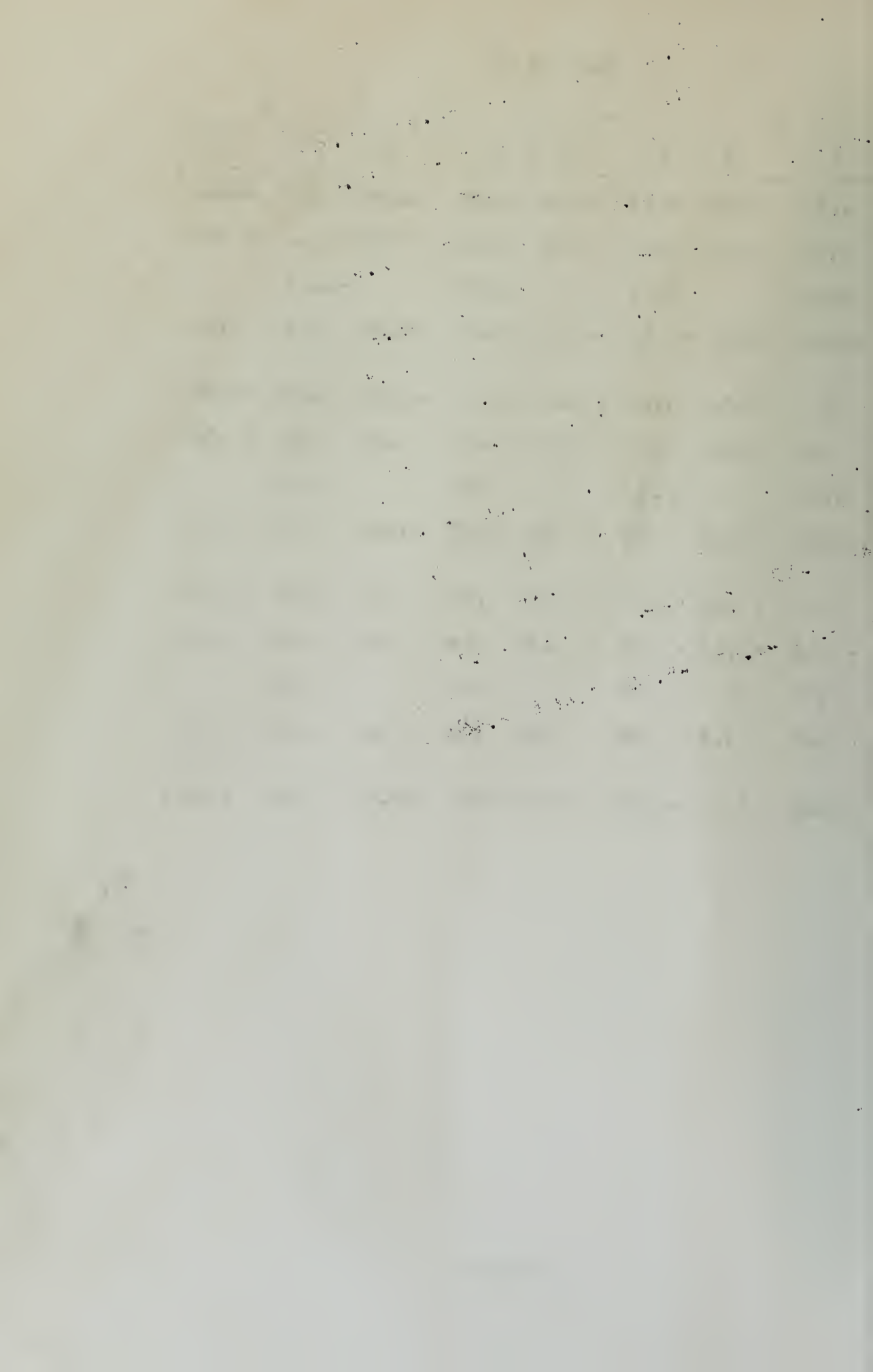
1954

Load at D

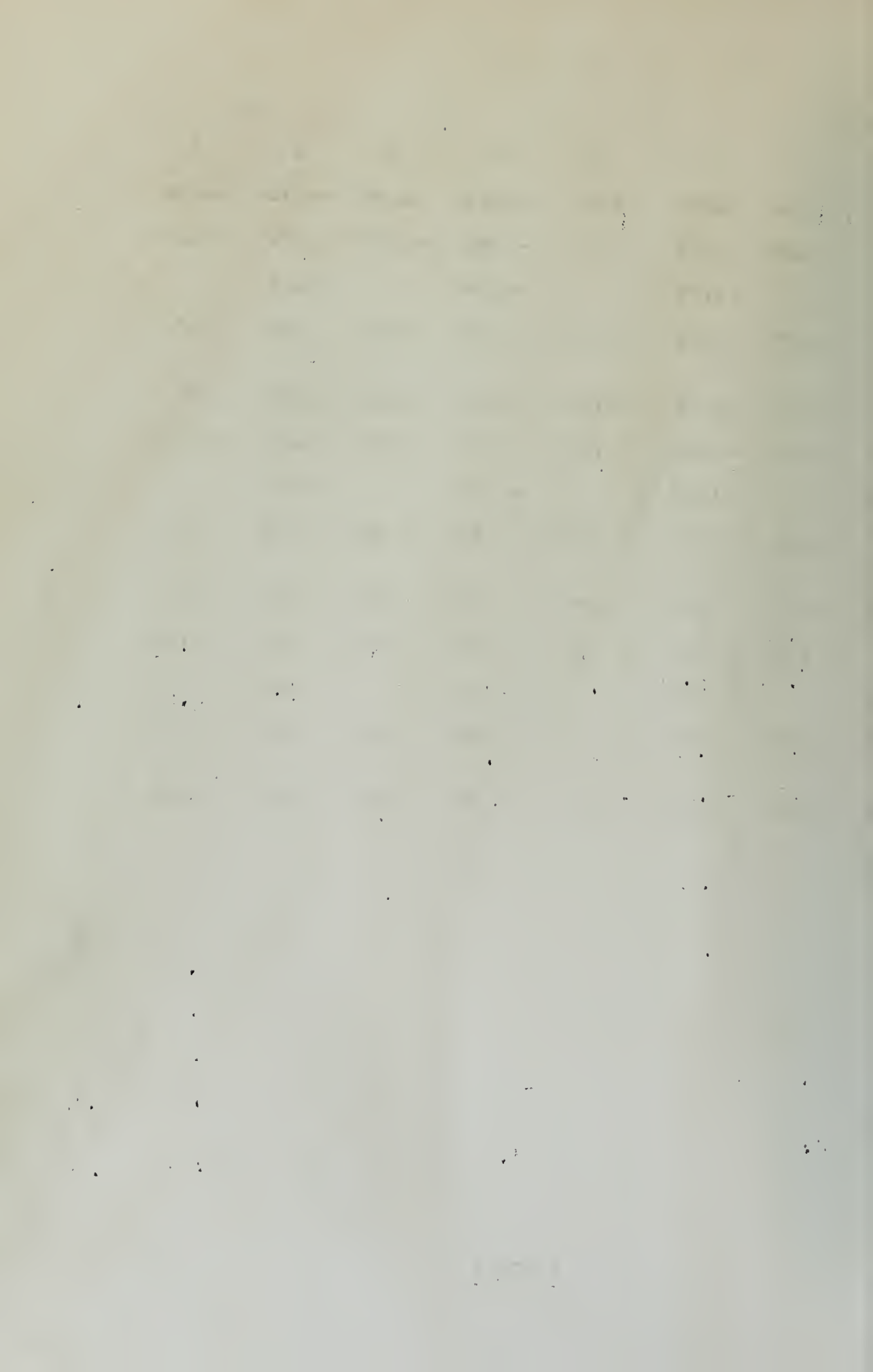
| anel | 1 | | 2 | | 3 | | 4 | |
|------|-------|-------|-------|-------|-------|-------|-------|-------|
| oint | A | B | B | C | C | D | D | E |
| Q | 4.38 | 4.49 | 4.31 | 4.36 | 3.98 | 4.12 | -2.82 | -2.82 |
| α | 2.79 | 2.91 | 2.33 | 1.66 | 1.21 | .96 | - .61 | - .48 |
| R | 5.40 | | 4.09 | | 2.99 | | -2.23 | |
| W | -4.64 | -4.40 | -3.72 | -5.08 | -3.90 | -4.29 | 2.76 | 2.90 |
| Q | 0 | 3.72 | 4.40 | 3.90 | 5.08 | -2.76 | 4.29 | -2.88 |
| | .61 | 1.72 | 2.32 | 1.55 | 1.28 | - .34 | .82 | - .38 |
| R | 1.74 | | 2.90 | | .72 | | .33 | |
| W | -1.08 | 1.08 | .80 | - .76 | 1.17 | -1.26 | .60 | - .60 |
| Q | 0 | - .80 | -1.08 | -1.17 | .76 | - .60 | 1.26 | - .04 |
| | - .13 | - .37 | - .59 | - .44 | .18 | - .09 | .25 | .01 |
| R | - .37 | | - .77 | | .08 | | .20 | |
| W | .24 | - .24 | - .16 | .16 | .18 | - .24 | .10 | - .14 |
| M | -5.48 | -3.56 | -3.08 | -5.68 | -2.53 | -5.79 | 3.46 | 2.16 |

Load at D

| nel | 1 | | 2 | | 3 | 4 | | |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|
| int | A | B | B | C | C | D | D | E |
| Q | 4.38 | 4.49 | 4.31 | 4.36 | 3.98 | 4.12 | -2.82 | -2.82 |
| X | 2.79 | 2.91 | 2.33 | 1.66 | 1.21 | .96 | - .61 | - .48 |
| R | 5.40 | | 4.09 | | 2.99 | | -2.23 | |
| M | -4.64 | -4.40 | -3.72 | -5.08 | -3.90 | -4.29 | 2.76 | 2.90 |
| Q | 0 | 3.72 | 4.40 | 3.90 | 5.08 | -2.76 | 4.29 | -2.88 |
| | .61 | 1.72 | 2.32 | 1.55 | 1.28 | - .34 | .82 | - .38 |
| R | 1.74 | | 2.90 | | .72 | | .33 | |
| M | -1.08 | 1.08 | .80 | - .76 | 1.17 | -1.26 | .60 | - .60 |
| Q | 0 | - .80 | -1.08 | -1.17 | .76 | - .60 | 1.26 | - .04 |
| | - .13 | - .37 | - .59 | - .44 | .18 | - .09 | .25 | .01 |
| R | - .37 | | - .77 | | .08 | | .20 | |
| M | .24 | - .24 | - .16 | .16 | .18 | - .24 | .10 | - .14 |
| M | -5.48 | -3.56 | -3.08 | -5.68 | -2.53 | -5.79 | 3.46 | 2.16 |



| | 5 | | 6 | | 7 | | 8 | |
|------|-------|-------|-------|-------|-------|-------|-------|--|
| E | F | F | G | G | H | H | I | |
| 2.82 | -2.82 | -2.46 | -2.37 | -2.61 | -2.58 | -2.70 | -2.64 | |
| .48 | - .60 | - .57 | - .72 | - .99 | -1.39 | -1.74 | -1.68 | |
| 2.22 | | -1.77 | | -2.46 | | -3.24 | | |
| 2.88 | 2.76 | 2.52 | 2.25 | 3.12 | 2.40 | 2.64 | 2.76 | |
| 2.90 | -2.52 | -2.76 | -3.12 | -2.25 | -2.64 | -2.40 | 0 | |
| .49 | - .55 | - .66 | - .93 | - .91 | -1.38 | -1.11 | - .39 | |
| .78 | | -1.20 | | -1.71 | | -1.12 | | |
| .04 | - .02 | .21 | - .18 | .44 | - .48 | - .72 | .72 | |
| .60 | - .21 | .02 | - .44 | .18 | .72 | .48 | 0 | |
| .09 | - .03 | - .01 | - .12 | .13 | .33 | .22 | .08 | |
| .04 | | - .10 | | .35 | | .22 | | |
| .08 | - .06 | .09 | - .09 | - .24 | .20 | .16 | - .12 | |
| 3.00 | 2.68 | 2.82 | 1.98 | 3.32 | 2.12 | 2.08 | 3.36 | |



Influence Line Corrections - First Set - Load at E

anel 1,8

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = 2.96$$

$$A = .49, B = 1.37, R_1 = 1.39$$

$$M_{AB} = 4(.49 + 1.37/2 - 1.39) = -.88$$

$$M_{BA} = 4(1.37 + .49/2 - 1.39) = .88$$

anel 2,7

$$2.52B - .93C = 3.52$$

$$-1.02B + 4.03C = 3.15$$

$$B = 1.86, C = 1.25, R_2 = 2.33$$

$$M_{BC} = 4(1.86 + 1.25/2 - 2.33) = .60$$

$$M_{CB} = 4(1.25 + 1.86/2 - 2.33) = -.60$$

anel 3,6

$$3.81C - .65D = 4.00$$

$$-.77C + 5.26D = 3.66$$

$$C = 1.20, D = .87, R_3 = 1.55$$

$$M_{CD} = 3(1.20 + .87/2 - 1.55) = .24$$

$$M_{DC} = 3(.87 + 1.20/2 - 1.55) = -.24$$

anel 4,5

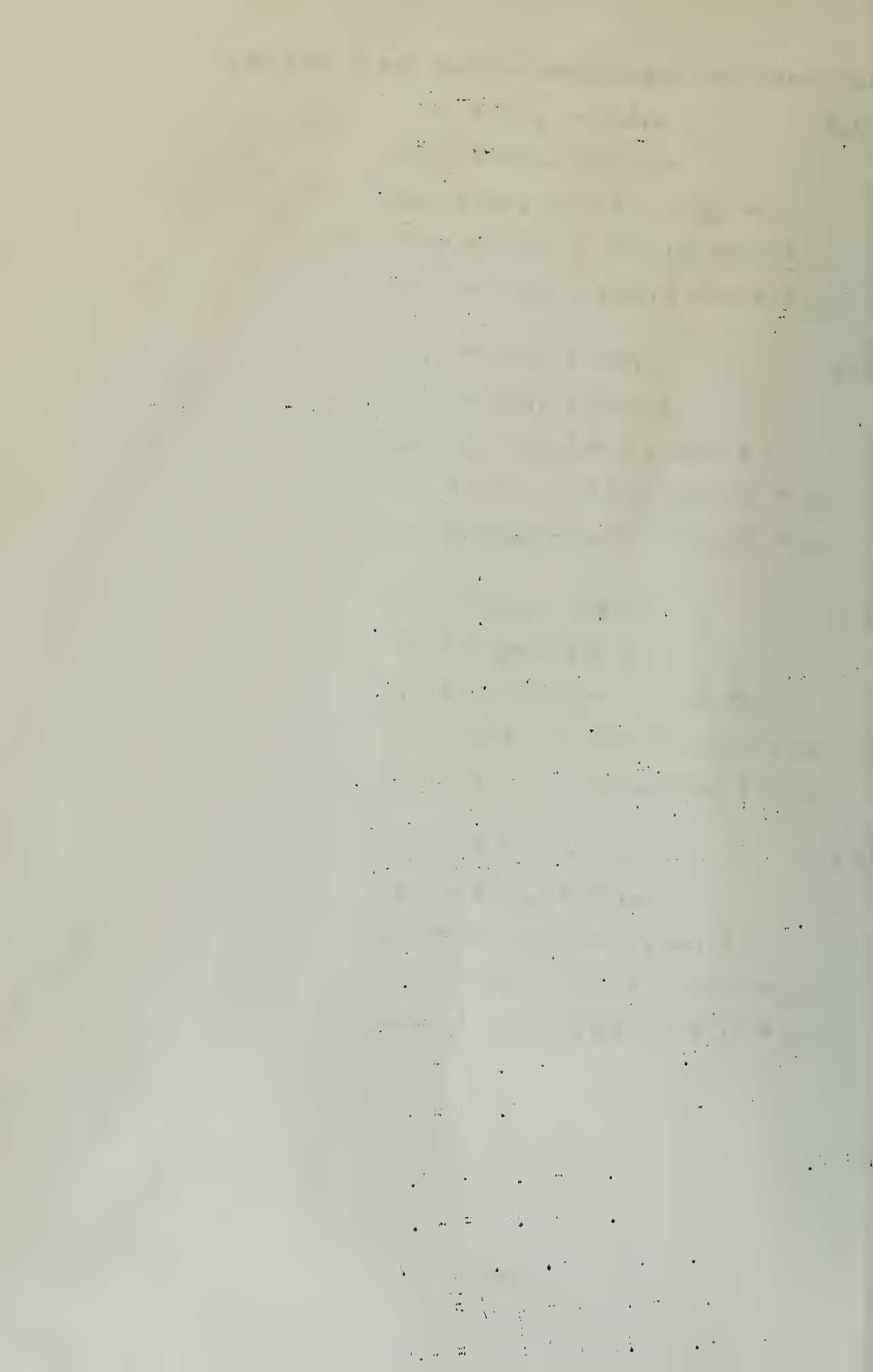
$$5.0D - .5E = 3.45$$

$$-1.5D + 6.5E = -.84$$

$$D = .64, E = -.54, R_4 = .08$$

$$M_{DE} = 2(.64 - .54/2 - .08) = .58$$

$$M_{ED} = 2(-.54 + .64/2 - .08) = -.60$$



Influence Line Corrections - Second Set - Load at E

Panel 1,8

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -.20$$

$$A = -.10, B = -.28, R_1 = -.28$$

$$M_{AB} = 4(-.10 - .28/2 + .28) = .16$$

$$M_{BA} = 4(-.28 - .10/2 + .28) = -.20$$

Panel 2,7

$$2.52B - .93C = -.88$$

$$-1.02B + 4.3C = -.24$$

$$B = -.41, C = -.16, R_2 = -.43$$

$$M_{BC} = 4(-.41 - .16/2 + .43) = -.24$$

$$M_{CB} = 4(-.16 - .41/2 + .43) = .24$$

Panel 3,6

$$3.81C - .65D = .60$$

$$-.77C + 5.26D = -.58$$

$$C = .14, D = -.09, R_3 = .04$$

$$M_{CD} = 3(.14 - .09/2 - .04) = .18$$

$$M_{DC} = 3(-.09 + .14/2 - .04) = -.18$$

Panel 4,5

$$5.1D - .51E = .24$$

$$-.5D + 6.5E = -.60$$

$$D = .04, E = -.09, R_4 = -.04$$

$$M_{DE} = 2(.04 - .09/2 + .04) = .06$$

$$M_{ED} = 2(-.09 + .04/2 + .04) = -.06$$

3

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1. 1. 1.

1. The first group of people who are interested in the study of the history of the United States are the people who are interested in the history of the United States.

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1. *Chlorophyll a* (Chl *a*)

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

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1. The first group of people who are interested in the study of the history of the United States are the people who are interested in the history of the United States.

10

Load at E

| Panel | 1 | | 2 | | 3 | | 4 | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Point | A | B | B | C | C | D | D | E |
| Q | 3.51 | 3.59 | 3.44 | 3.49 | 3.18 | 3.30 | 3.25 | 3.75 |
| X | 2.22 | 2.33 | 1.86 | 1.33 | .97 | .77 | .82 | .64 |
| R | 4.32 | | 3.26 | | 2.40 | | 2.97 | |
| L | -3.76 | -3.52 | -2.96 | -4.00 | -3.15 | -3.45 | -3.66 | -3.84 |
| Q | 0 | 2.96 | 3.52 | 3.15 | 4.00 | 3.66 | 3.45 | -3.84 |
| X | .49 | 1.37 | 1.86 | 1.25 | 1.20 | .87 | .64 | -.54 |
| R | 1.39 | | 2.33 | | 1.55 | | .08 | |
| L | .88 | .88 | .60 | -.60 | .24 | -.24 | .58 | -.60 |
| Q | 0 | -.60 | -.88 | -.24 | .60 | -.58 | .24 | -.60 |
| X | .10 | -.28 | -.41 | -.16 | .14 | -.09 | .04 | -.09 |
| R | -.28 | | -.3 | | .04 | | .04 | |
| L | .16 | -.20 | -.24 | .24 | .18 | .18 | .06 | -.06 |
| L | -4.48 | -2.84 | -2.60 | -4.36 | -2.73 | -3.87 | -3.02 | -4.50 |

| | 5 | 6 | | 7 | | 8 | |
|------|-------|-------|-------|-------|-------|-------|--------|
| E | F | F | G | G | H | H | I |
| 3.75 | -3.75 | -3.30 | -3.18 | -3.49 | -3.44 | -3.59 | -3.51 |
| .64 | - .82 | - .77 | - .97 | -1.33 | -1.86 | -2.73 | -2.22 |
| 2.97 | | -2.40 | | -3.26 | | -4.32 | |
| 3.84 | 3.66 | 3.45 | 3.15 | 4.00 | 2.96 | 3.52 | 3.76 |
| 3.84 | -3.45 | -3.66 | -4.00 | -3.15 | -3.52 | -2.96 | 0 |
| .54 | - .64 | - .87 | -1.20 | -1.25 | -1.86 | -1.37 | - .149 |
| .08 | | -1.55 | | -2.33 | | -1.39 | |
| .60 | - .58 | .24 | - .24 | .60 | - .60 | - .88 | .88 |
| .60 | - .24 | .58 | - .60 | .24 | .88 | .60 | 0 |
| .09 | - .04 | .09 | - .14 | .16 | .41 | .28 | .10 |
| .04 | | - .04 | | .43 | | .28 | |
| .06 | - .06 | .18 | - .18 | .24 | .24 | .20 | - .16 |
| 4.50 | 3.02 | 3.87 | 2.73 | 4.36 | 2.60 | 2.84 | 4.48 |

Moment Computations - Web Members

Member AA' DL = 3510 fk
 LL-E60 = 3008
 Impact = 644
 Total = 7162

LL H15-S12-44 = 412
 Conc. = 97
 Impact = 70
 Total = 579

Sidewalk = 246

Design Moment = 7,937 fk

Member BB' DL = 3980 fk
 LL-E60 = 3395
 Impact = 725
 Total = 8100

LL H15-S12-44 = 465
 Conc. = 109
 Impact = 78
 Total = 652

Sidewalk = 278

Design Moment = 9,030 fk

Member CC' DL = 3690 fk
 LL-E60 = 3200
 Impact = 736
 Total = 7626

LL H15-S12-44 = 432
 Conc. = 101
 Impact = 80
 Total = 613

Sidewalk = 258

Design Moment = 8,497 fk

ber DD'

DL = 2422 f.k.

LL-E60 = 2193

Impact = 590

Total = 5205

LL H15-S12 - 44 = 284

Conc. = 97

Impact = 66

Total = 447

Sidewalk = 192

Design Moment = 5,844 f.k.

ber EE'

DL = 1323 f.k.

LL-E60 = 1272

Impact = 445

Total = 3040

LL H15-S12-44 = 155

Conc. = 73

Impact = 47

Total = 275

Sidewalk = 120

Design Moment = 3,435 f.k.

Moment Computations - Chord Members

Member AB

| | | |
|--------|---|-----------|
| DL | = | 3510 f.k. |
| LL-E60 | = | 3008 |
| Impact | = | 644 |
| <hr/> | | |
| Total | = | 7162 |

| | | |
|---------------|---|-----|
| LL H15-S12-44 | = | 412 |
| Conc. | = | 97 |
| Impact | = | 70 |
| <hr/> | | |
| Total | = | 579 |
| Sidewalk | = | 246 |

Design Moment = 7,987 f.k.

Member BC

| | | |
|--------|---|-----------|
| DL | = | 3120 f.k. |
| LL-E60 | = | 2800 |
| Impact | = | 642 |
| <hr/> | | |
| Total | = | 6562 |

| | | |
|---------------|---|-----|
| LL H15-S12-44 | = | 365 |
| Conc. | = | 105 |
| Impact | = | 71 |
| <hr/> | | |
| Total | = | 541 |

Sidewalk = 226

Design Moment = 7,329 f.k.

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er CD

| | | |
|---------------|---|------|
| DL | = | 1828 |
| W-E60 | = | 1692 |
| Impact | = | 434 |
| <hr/> | | |
| Total | = | 3954 |
| LL H15-S12-44 | = | 214 |
| Conc. | = | 78 |
| Impact | = | 49 |
| <hr/> | | |
| Total | = | 341 |
| Sidewalk | = | 141 |

Design Moment = 4,436 f.k.

er DE

| | | |
|---------------|---|------|
| DL | = | 1172 |
| W-E60 | = | 1138 |
| Impact | = | 342 |
| <hr/> | | |
| Total | = | 2652 |
| LL H15-S12-44 | = | 137 |
| Conc. | = | 61 |
| Impact | = | 37 |
| <hr/> | | |
| Total | = | 235 |
| Sidewalk | = | 99 |

Design Moment = 2,986 f.k.

1891
 1892
 1893

1894
 1895
 1896

1897
 1898
 1899

1900
 1901
 1902

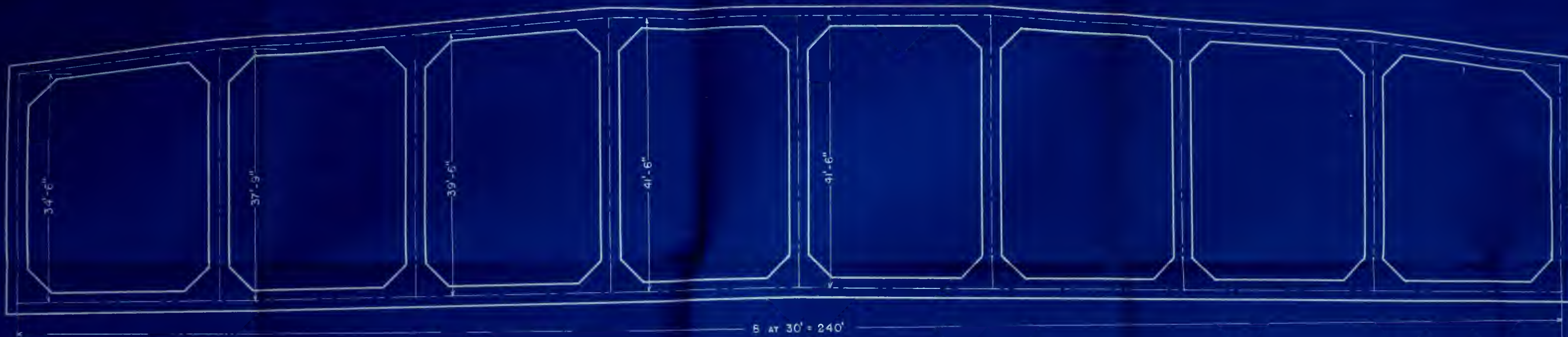
1903
 1904
 1905

1906
 1907
 1908

1909
 1910
 1911

1912
 1913
 1914

1915
 1916
 1917



$$m = \frac{37.75 - 34.50}{37.75} = 0.0866$$

$$m = \frac{39.50 - 37.75}{39.50} = 0.0443$$

$$m = \frac{41.50 - 39.50}{41.50} = 0.0482$$

$$m = \frac{41.50 - 41.50}{41.50} = 0$$

$$m = \frac{41.50 - 41.50}{41.50} = 0$$

$$m = \frac{41.50 - 39.50}{41.50} = 0.0482$$

$$m = \frac{39.50 - 37.75}{39.50} = 0.0443$$

$$m = \frac{37.75 - 34.50}{37.75} = 0.0866$$

$$n = \frac{37.75 - 34.50}{34.50} = 0.0942$$

$$n = \frac{39.50 - 37.75}{37.75} = 0.0463$$

$$n = \frac{41.50 - 39.50}{39.50} = 0.0507$$

$$n = \frac{41.50 - 41.50}{41.50} = 0$$

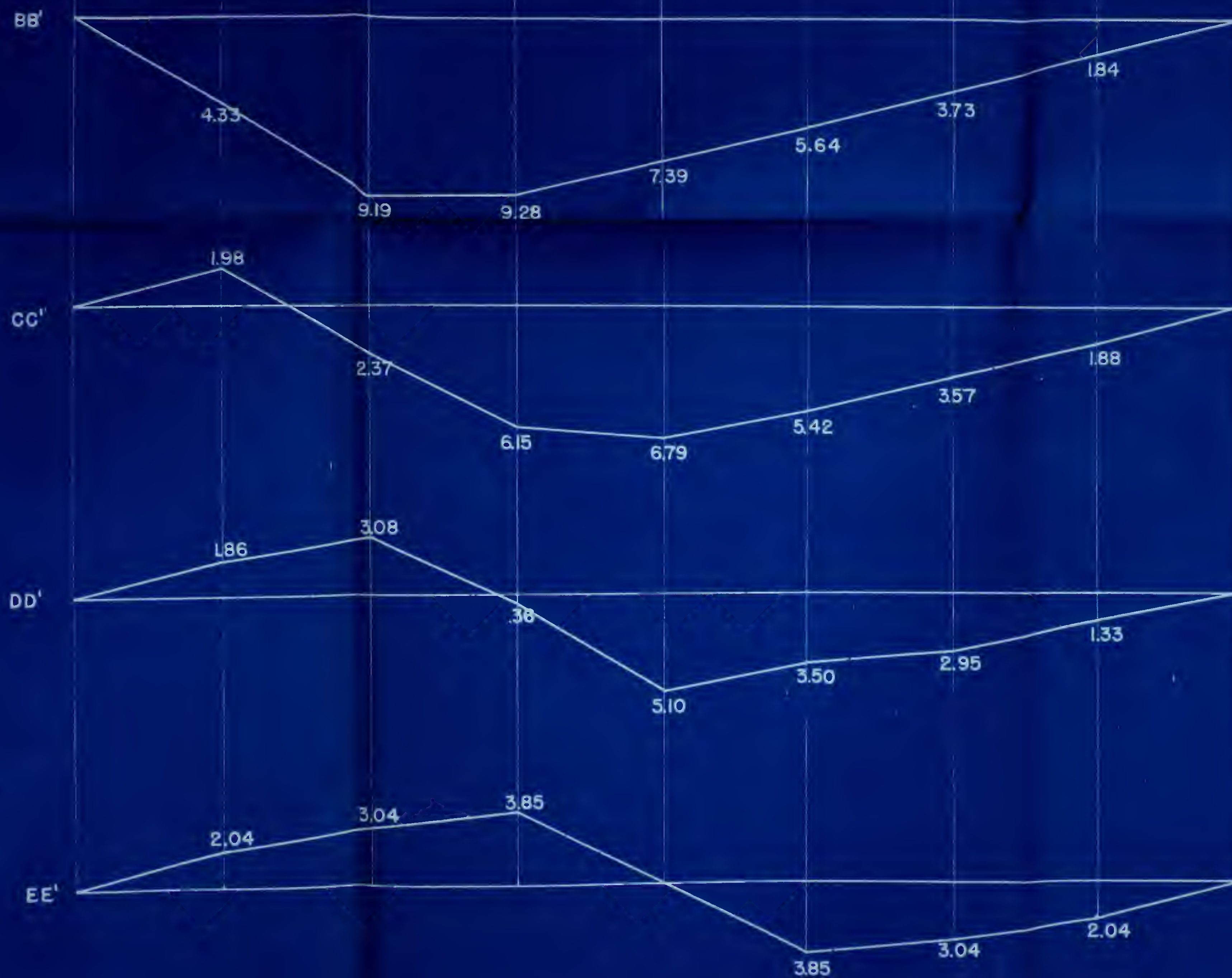
$$n = \frac{41.50 - 41.50}{41.50} = 0$$

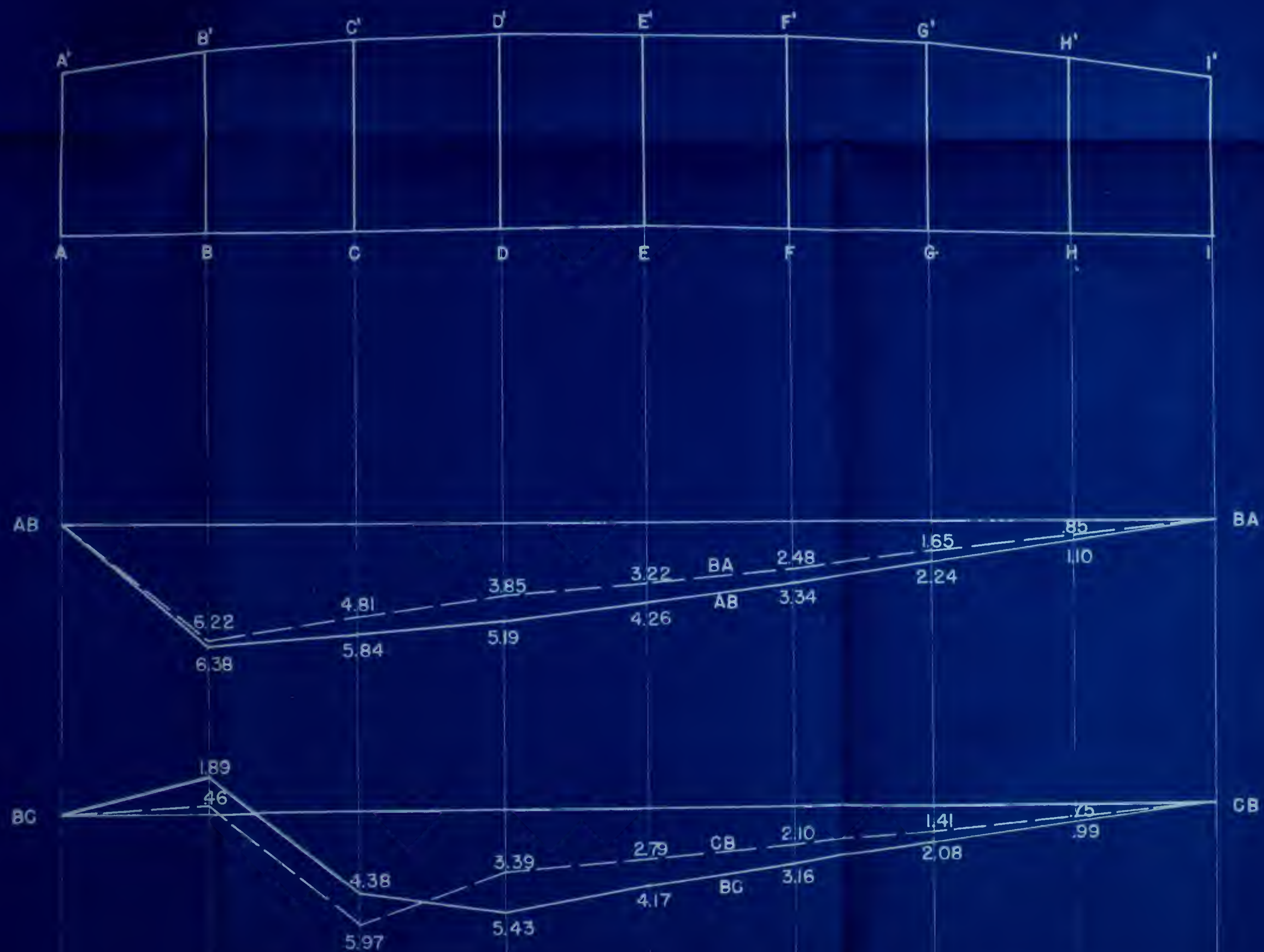
$$n = \frac{41.50 - 39.50}{39.50} = 0.0507$$

$$n = \frac{39.50 - 37.75}{37.75} = 0.0463$$

$$n = \frac{37.75 - 34.50}{34.50} = 0.0942$$

ELEVATION
VIERENDEEL TRUSS
RENSSELAER POLYTECHNIC INSTITUTE
JUNE 1948
J. J. MANNING JR.
SCALE 1" = 10'
L. H. EDING







INFLUENCE LINES

FIRST SET

VIERENDEEL TRUSS

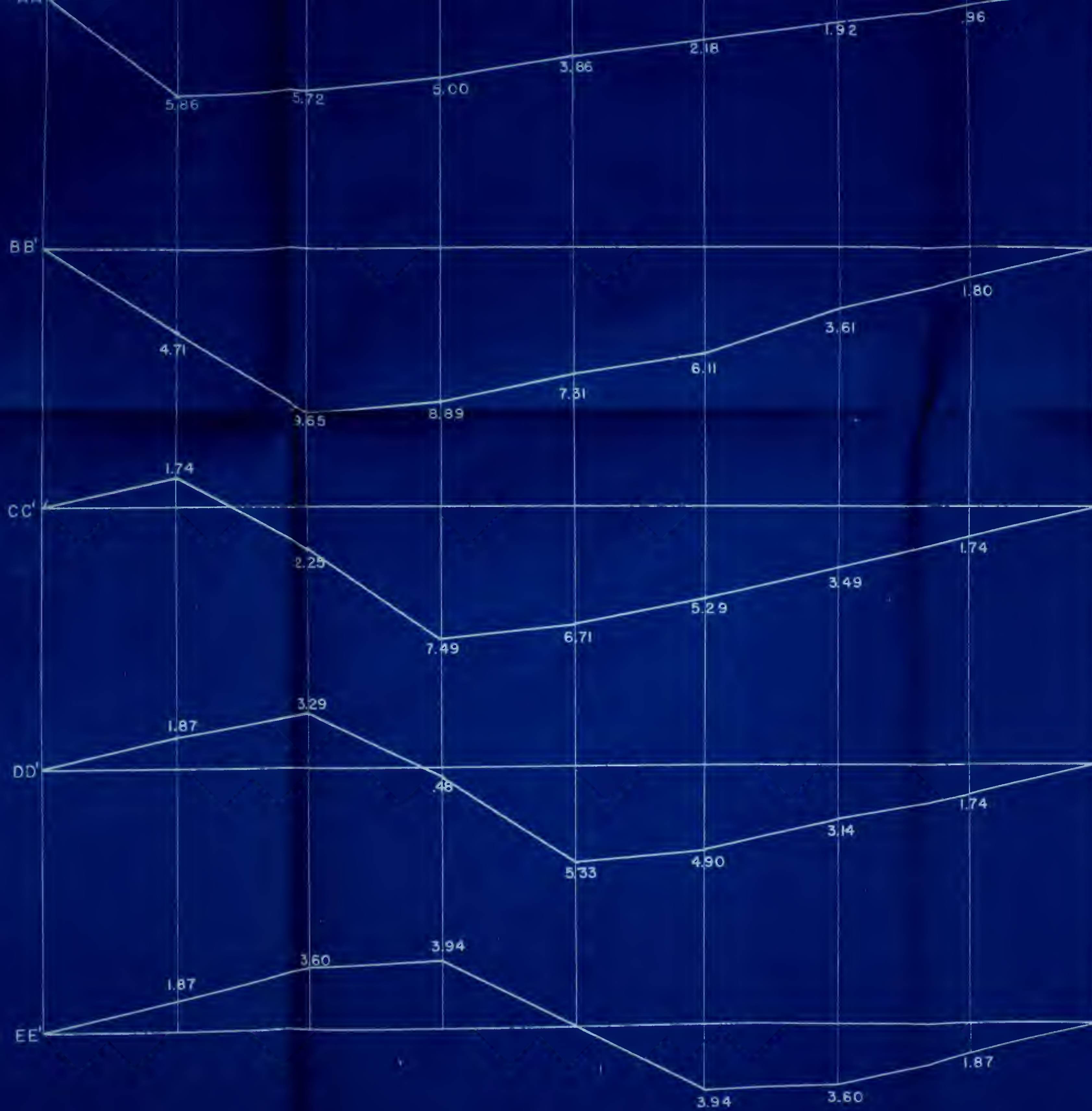
RENSSELAER POLYTECHNIC INSTITUTE

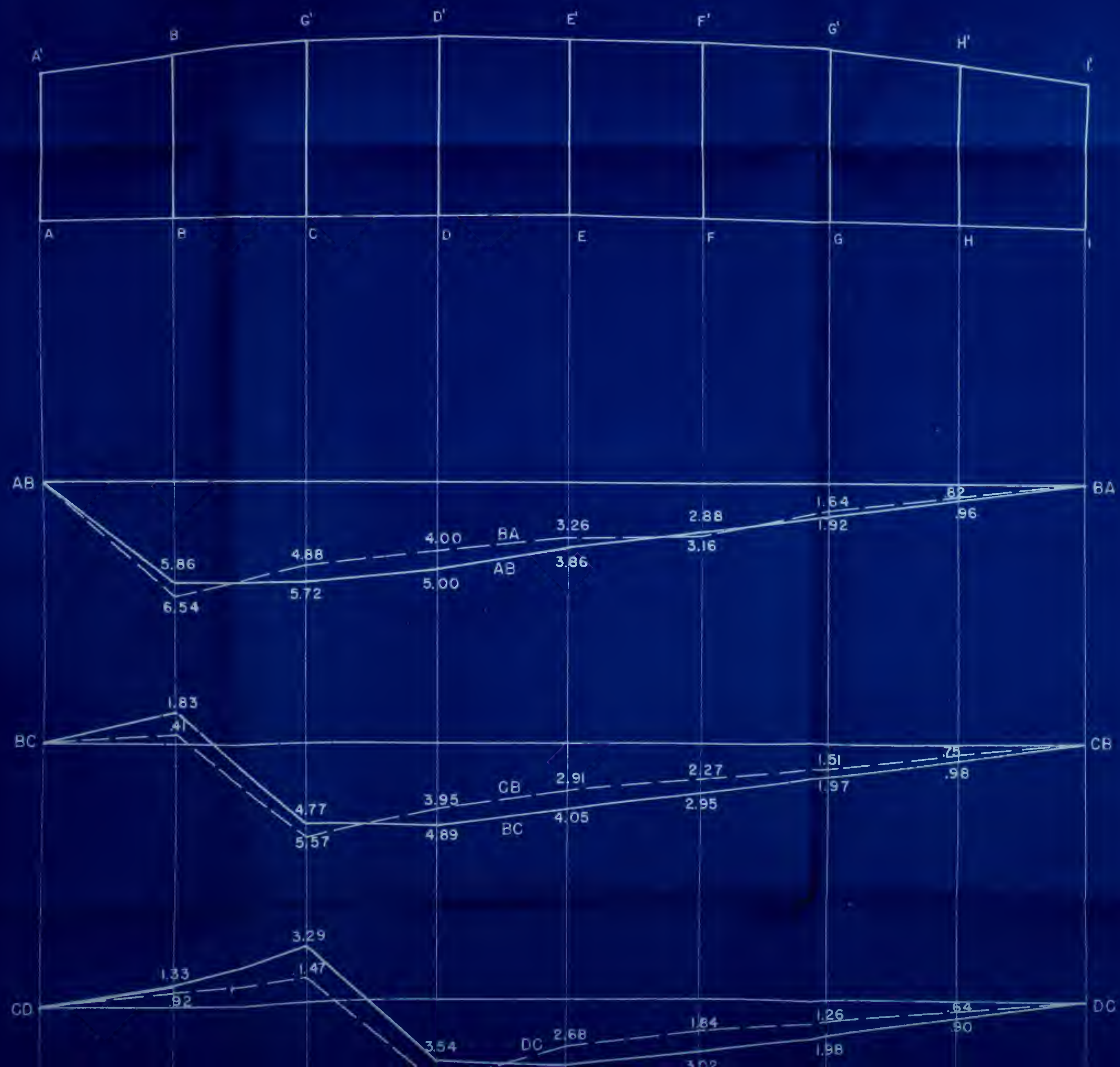
JUNE 1948

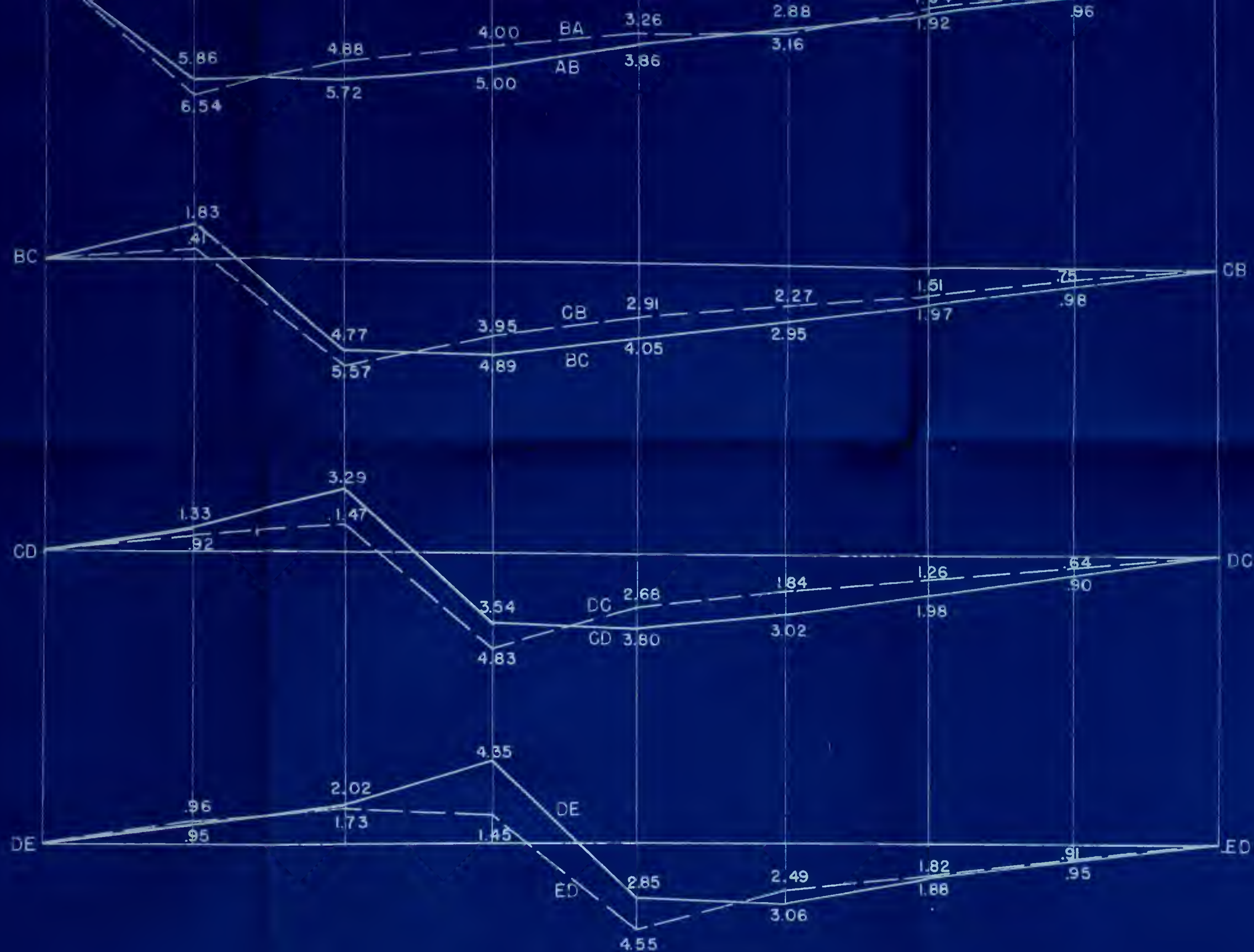
J. J. MANNING JR.

1" = 5 F.K.

L. H. EDING







INFLUENCE LINES FIRST SET VIERENDEEL TRUSS

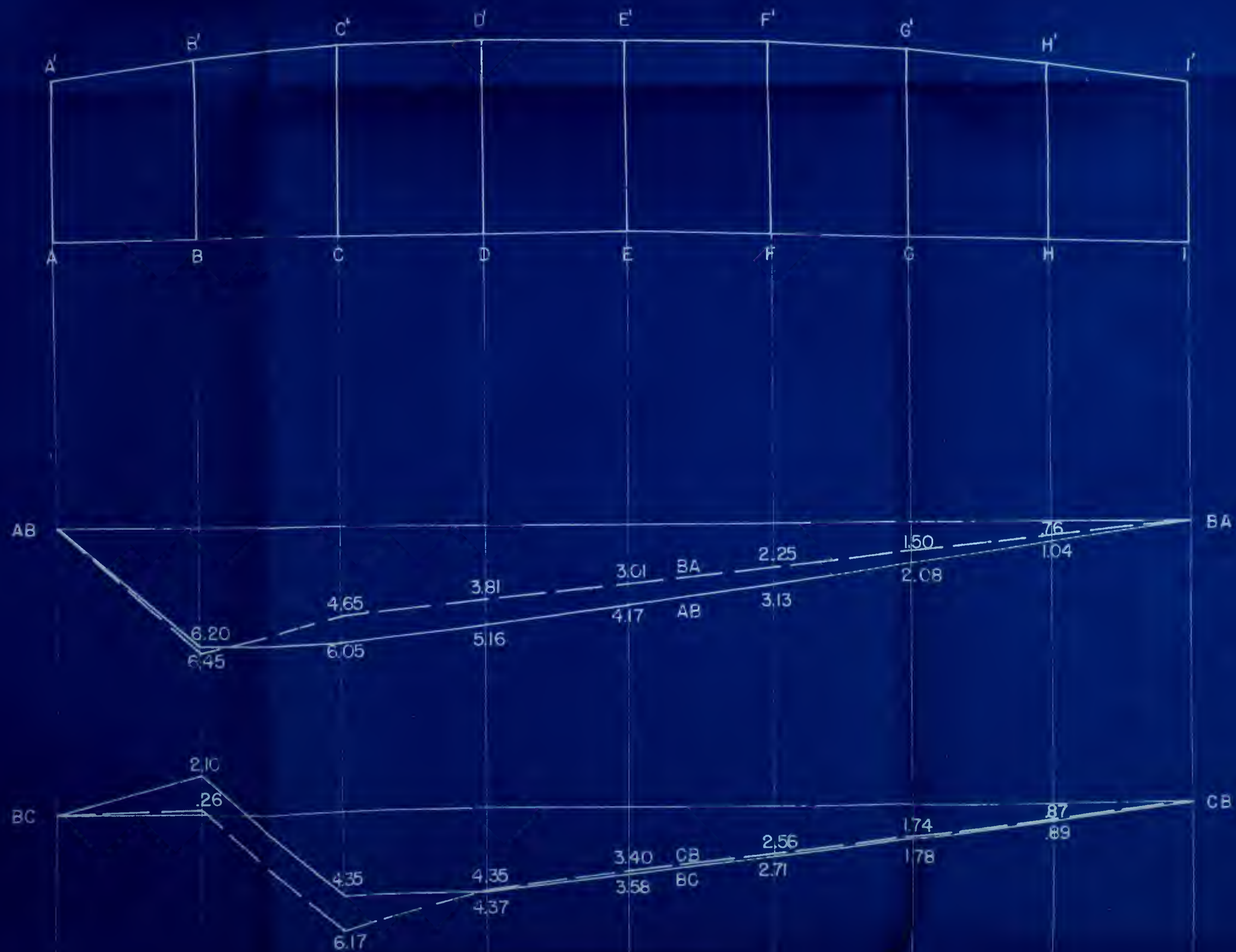
RENSSELAER POLYTECHNIC INSTITUTE

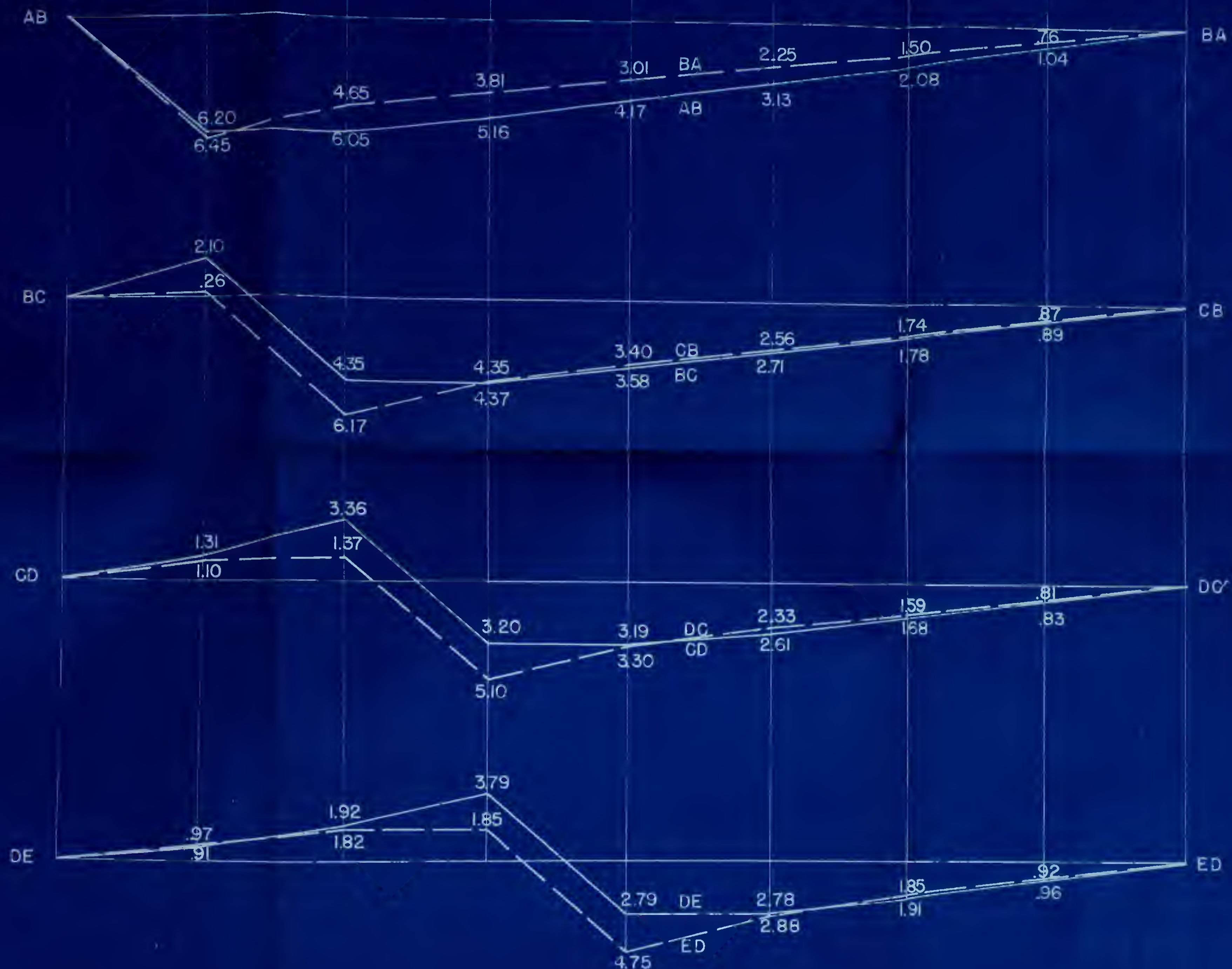
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1" = 5 F. K.

L. H. EDING





INFLUENCE LINES

THIRD SET

VIERENDEEL TRUSS

RENSSELAER POLYTECHNIC INSTITUTE

JUNE 1948

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1"=5 F.K.

L. H. EDING



INFLUENCE LINES FOURTH SET VIERENDEEL TRUSS

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JUNE 1948 J. J. MANNING JR.
1" = 5 F. K. L. H. EDING

DATE DUE

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Thesis

6889

M3 Manning

Investigation of the
effect of stiffness of
members upon the solution
of Vierendeel trusses.

Thesis

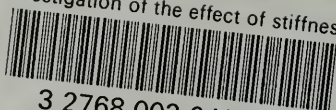
6889

M3 Manning

Investigation of the
effect of stiffness of
members upon the solution
of Vierendeel trusses.

thesM3

Investigation of the effect of stiffness



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